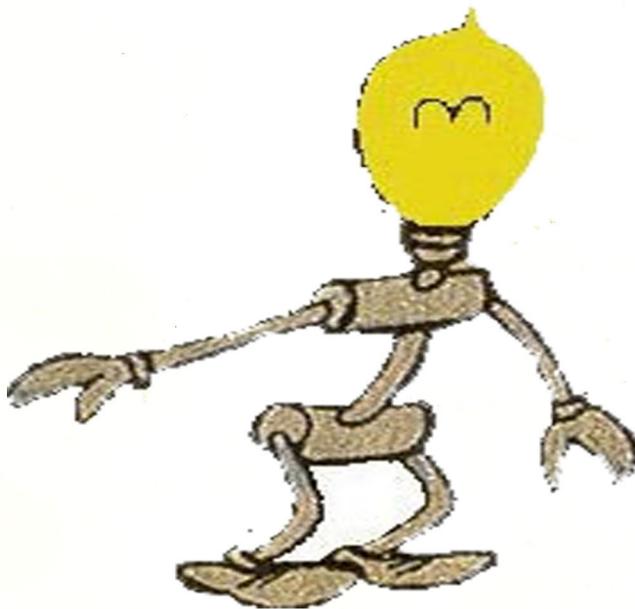


STEREO-CODER

SCB-60

# **Tratec** **Holland**

*Satellite & Cable TV systems*



PASSIVE COMPONENTS

SATELLITE EQUIPMENT

RADIO - PROCESSING

VIDEO - PROCESSING

Complete calibration:

Important: in case of a large deviation from specified value do not try to calibrate; follow first the maintenance procedure.

1) Power supply

Check for plus and minus 15 volt ( $\pm 0,5V$ ) over C10 and C9 of the summing amplifier, use the minus side of C9 as common.

2) Short L and R inputs, short additional inputs

Mode : Stereo  
Pilot : Off  
Pre-emphasis : Off  
Scope MPX output

a. 38kHz Residual

Adjust R2 on buffer amplifier for a minimum 38kHz on output

b. 19kHz Residual

Adjust P.A. zero on motherboard for a minimum 19kHz on output

c. DC Output level

Adjust output D.C. on summing amplifier for a minimum D.C. level on the MPX output.

3) Pilot Frequency

Connect a calibrated frequency counter between common and U2 pin 1 on the time base board and adjust C3 on this board for  $532000Hz \pm 3Hz$ .

4) Levels

Mode: stereo, pilot off, pre-emphasis off, input 1kHz + 6dBm in phase to the L and R inputs.

a. Adjust "gain right" for +6dBm on the output of the right buffer amplifier module.

b. Adjust "gain left" for +6dBm on the output of the left buffer amplifier module.

c. Adjust "MPX outputlevel" on summing amplifier module for +6dBm outputlevel on the MPX output.

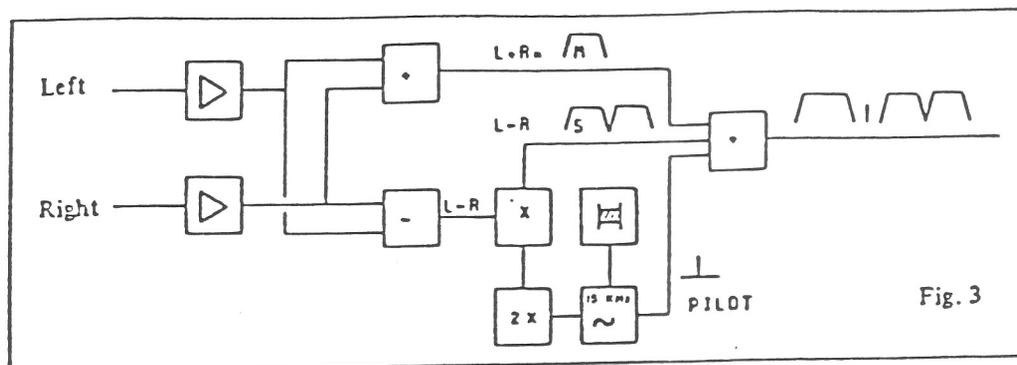
## 5) Mode: stereo, pilot on, pre-emphasis off, no input signal.

a. Adjust R36 "Pilot AMP" for the desired pilotlevel.

### The matrix method

The problems encountered in the switching method, such as poor suppression above 53kHz, and decreasing left-right cross-talk above 5kHz, all caused by the lowpass filter, are absent in the matrix method.

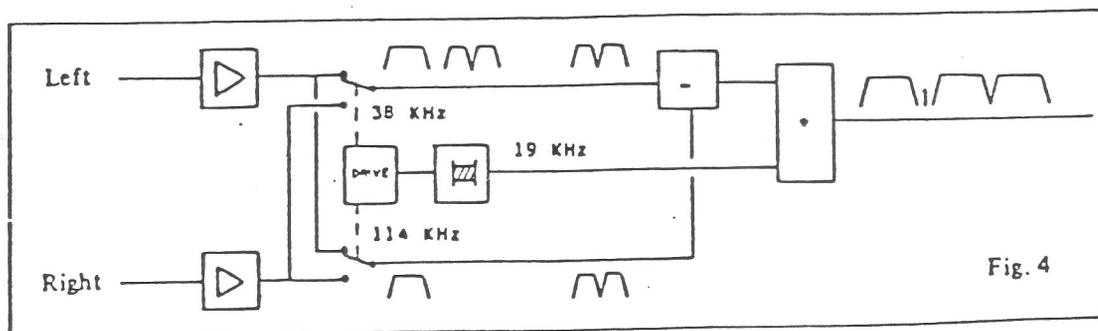
The **Tratec** SGB-60 stereo encoder, in which this method was put to practice for the first time, features a channel separation of more than 46dB over the entire frequency range of 30Hz to 15kHz. In the matrix method, the desired signal is generated in separate parts, which are next added as shown in fig. 3.



The system offers the following advantages: an extremely good left-right channel separation which is hardly frequency dependent, a clean spectrum above 53kHz, and a large signal-to-noise ratio. A disadvantage of this method is that the 38kHz carrier suppression and the phase between pilot tone and 38kHz are much more temperature dependent than in the switching method. For this reason, the temperature dependent elements in the SC-11 stereo encoder are housed in a temperature oven with constant temperature. A rather extended adjusting procedure is necessary.

### Intermediate form

Recently stereo encoders were introduced which have very good specifications. In this encoders an attempt was made to combine the advantages of both systems. The stereo encoded signal is generated according to the switching method. By very careful adjustment of the time symmetry, the 76kHz component is suppressed as far as possible, while the undesired 114kHz component occurs normally. At the same time, also according to the switching method, a separate 114kHz component is generated, which, as far as possible, is equal to the undesired 114kHz component. In a differential amplifier desired and undesired 114kHz components are balanced. Fig. 4 shows the principle.



Advantage of this method is that the left-right channel separation can be very high, and the distortion low. As a disadvantage must be reckoned that the desired 114kHz component must be exactly equal in amplitude and phase to the undesired signal for the result to be null. In this process of balancing, like in the matrix method, temperature problems emerge. Apart from that, a lengthy adjustment is called for.

All data are guaranteed minimum values

**Inputs for left- and right channel**

- |     |   |  |
|-----|---|--|
| A1  | Frequency range .....   | 20Hz—15kHz   |
| A2  | Input configuration.....  | Symmetrical with respect to ground, asymmetrical use possible without loss |
| A3  | Input impedance.....  | 2 x 22 kilo-ohm, can be changed into 2 x 600 ohm or 2 x 100 kilo-ohm       |
| A4  | Common mode rejection.....  | 20Hz — 15kHz >54dB   |
| A5  | Input level for +6dBm output level.....   | +6dBm  |
| A6  | Input attenuator range .....  | + and -3dB with respect to +6dBm   |
| A7  | Maximum overdrive of both inputs.....   | +9dB with respect to +6dBm (at 200Hz)                                      |
| A8  | Maximum amplitude difference after equalizing left and right input at 1000Hz .. | <0.1dB from 20Hz — 15kHz   |
| A9  | Rejection of unwanted input frequencies with respect to +6dBm input signal..... | >54dB (19kHz) >50dB (>19kHz)   |
| A10 | Amplitude-frequency ripple of the low-pass filters in both inputs .....         | <±0.15dB from 20Hz — 15kHz   |
| A11 | Pre-emphasis switchable on frontpanel ...                                       | 50μSec. ±1%, changeable in 25μSec. ±1% or 75 μSec. ±1%                     |

**OUTPUT OF THE ENCODED STEREO SIGNAL**

C1	Configuration .....	asymmetrical or symmetrical with respect to ground, short circuit proof
C2	Nominal output level.....	+6dBm $\pm$ 0.1dB
C3	Maximum output level without change of specifications .....	+15dBm
C4	Output impedance.....	<2 ohm, or <2 x 2 ohm
C5	Nominal load.....	600 ohm
C6	Maximum load .....	200 ohm + parr. 5000pF
C7	Amplitude unbalance of the symmetrical output.....	<0.1dB
C8	Output level difference with shortened MONO output.....	<0.1dB

**19kHz PILOT-TONE MP**

E1	Frequency.....	19kHz $\pm$ 0.5Hz
E2	Type of signal .....	square wave
E3	Duty cycle.....	50%
E4	Output level .....	1V p-p
E5	Output impedance.....	600 ohm short circuit proof

**38kHz SYNCHRONISATION POINT**

F1	Location .....	internal, optional at the rearpanel
F2	Frequency.....	38kHz
F3	Type of signal .....	square wave
F4	Duty cycle.....	50%
F5	Output level .....	1V p-p
F6	Output impedance.....	600 ohm short circuit proof

**GENERAL SPECIFICATIONS****Amplitude-frequency characteristic**

G1	Amplitude-frequency characteristic.....	<0.5dB (output mpx or mono max. load. Ref. freq. between 20Hz and 15kHz 1000Hz. Ref. level +6dBm, pre-emphasis off)
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**Signal-to-noise ratio's** ref +6dBm output level, pre-emphasis off, mono mode.

G2-1	Signal-to-noise ratio.....	>90dB RMS ( $\geq$ 95dB typical) (flat 20Hz - 20kHz RMS)
G2-2	Signal-to-noise ratio peak value.....	>90dB ( $\geq$ 95dB typical) according to DIN 45405
G2-3	Signal-to-noise ratio peak value.....	>88dB ( $\geq$ 90dB typical) according to CCIR 468-1
G2-4	Signal-to-noise ratio according to .....	>95dB ( $\geq$ 100dB typical) CCITT P53

## CONTENTS

Section G : G1 - G4	General information about stereo encoding techniques
Section S : S1 - S4	Specifications SGB 60
S5 - S8	Typical frequency spectrum
Section D :	Technical description
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D1	Frontpanel
D2	Input amplifier, 15kHz filter
D3	Buffer amplifiers Electronic potentiometer Time base
D4	Pilot control
D5	Summing amplifier, 120kHz filter
D6	MPX output amplifiers
Section C : C1 - C6	Calibration
Section T :	Trouble shooting and schematics
Section P :	Partslist

## GENERATION OF STEREO CODER SIGNALS

The left and right audio signals of a program must be converted to a stereo encoded — or commonly referred to as a multiplex — signal, before it can be applied to the modulator of an FM transmitter. Specifications for this signal are laid down in the CCIR recommendation 450.

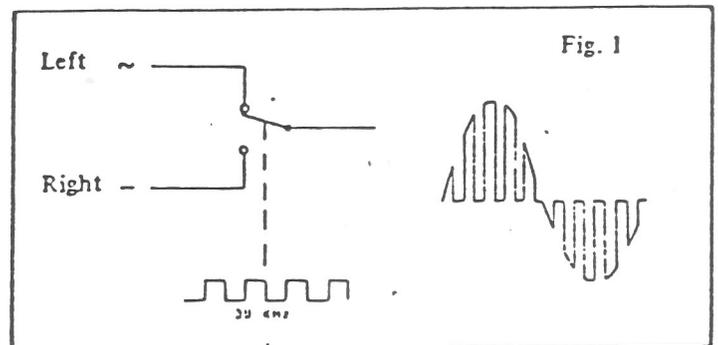
The stereo-encoded signal which has a bandwidth of 53kHz, consists of:

1. A mono part composed of left + right (M)
2. A 19kHz pilot tone
3. A stereo part, consisting of a double sideband, AM modulated signal with a suppressed 38kHz carrier (S)

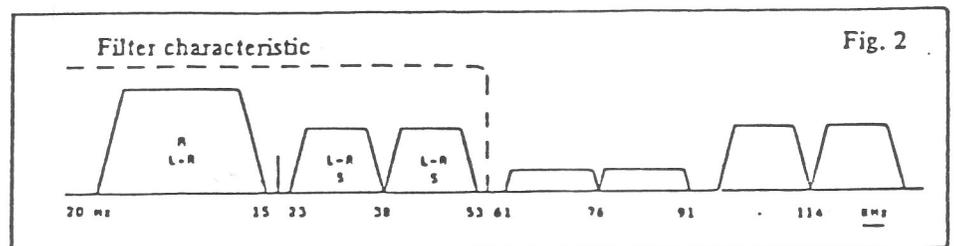
In general two principles have been used so far in generating this signal. The methods are called time multiplex or switching method and frequency multiplex or matrix method.

### The switching method

Generation of the stereo encoded signal is effected by means of an electronic switch, which in a 38kHz rhythm alternately connects the left and right input signals to the output. The principle and the corresponding signal are depicted in fig. 1.



This method has great advantages, but even greater disadvantages; advantages being great simplicity, the insensitivity to temperature changes, the M and S signals being obtained simultaneously in one operation, and channel separation being maximum. A great disadvantage, however, is that undesired harmonics occur. This is shown in fig. 2.



The signal thus obtained will only be fit for use if a low bandpass filter is used, which will not pass any frequency above 53kHz. The filter should have very steep falloff characteristics because the lowest sideband of the harmonic at 76kHz already occurs at 61kHz. Although theoretically, the 76kHz does not occur in the switching method, an undesired signal is often generated through time asymmetry which, however, is considerably weaker than the 114kHz component.

Although such a filter is feasible, this requirement can hardly be combined with the characteristics which the filter should of necessity have, namely an amplitude ripple smaller than 0.05dB and a phase deviation of less than 0.05 degree over the entire range of 20Hz to 53kHz.

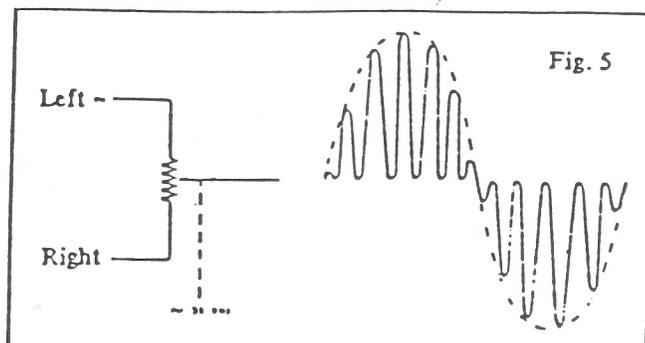
In actual practice, a compromise should be reached between these characteristics. Stereo encoders using the switching method, are often found to have poor suppression of frequencies above 53kHz, while the channel separation above frequencies of 5000Hz decreases by 6dB per octave. This sort of encoder in actual practice, has a worse than 9dB cross-talk at 15kHz than at 5kHz. Moreover, especially at higher modulation frequencies, phase shifts occur, which under certain circumstances may lead to distortion like sounding cross talk in the receiver, which by the ear is interpreted as distortion.

### The sinusoidal switching principle of the SGB-60

After a profound study in how far it would be possible to improve upon the three known generation methods, it was found that the inherent characteristics of each method were too great limiting factors.

One thing became clear, however, the switching method in itself was the most ideal, but the absolutely necessary lowpass filter cancels out the good characteristics.

The ideas which form the basis for the patent application, the adoption of the good characteristics of the switching method, without their being influenced by a lowpass filter, are fairly simple. The higher harmonics of the 38kHz occur because a square wave is used for switching between left and right (see fig. 1). If this square wave were a pure sinus, no harmonics would occur. In that case, however, a switch cannot be used. In order to facilitate the output between left and right channel to vary sinusoidal, a potentiometer must be used. See fig. 5.

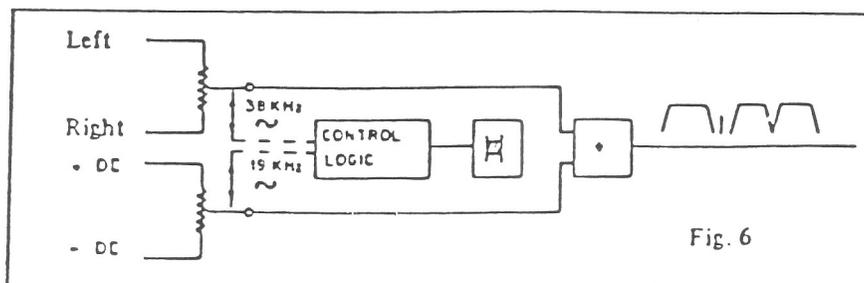


Great advantage of this system is that no undesired products occur, provided that the 38kHz sinus has low distortion. Apart from that all the advantages of the switching method have been retained, i.e. the very good channel separation, low distortion and low temperature sensitivity. Moreover, the M and S signals are generated in one operation so that the circuit remains relatively simple and no problems of correctly adding the M and S signals occur.

One last problem remained to be solved, the phase lock between pilot-tone and the 38kHz auxiliary carrier. Phase equality between the two signals is a condition for high channel separation, when the multiplex signal is to be decoded again into a left and right channel. In the systems used so far, the pilot-tone was generated separately, or derived from the 38kHz, and added to the multiplex signal by means of an adder. By this method the 38kHz signal and the 19kHz pilot-tone do not follow the same signal chain which necessitates phase compensation.

Disadvantage of this method is that the phase between both signals can be influenced by temperature variations and aging of components which results in a decrease of the channel separation after decoding. This disadvantage necessitates making the pilot-tone presettable, which must be regarded a great disadvantage in view of the accuracy with which must be measured and adjusted. As an illustration of the importance of the phase the following example is given: If the phase between pilot-tone and 38kHz auxiliary carrier shows a deviation of 0.3 degrees (which means that a time difference exists between the pilot-tone and 38kHz of more than 43 nanosecond), then the maximum obtainable channel separation is 55dB only!  $(\frac{0.3}{179.9} \log \times 20)$

In designing the SGB 60a method has been sought which would keep pilot and 38kHz phase equal under all circumstances, eliminating the necessity of complex adjustments. In the end, the same method was used for generation of both pilot-tone and multiplex signal. In the patent application the principle is described in greater detail. Fig. 6 elucidates the matter.



The 38kHz and the 19kHz are both derived from the same crystal oscillator so that no time variation occurs. The upper potentiometer generates the multiplex signal while the lower one generates a sinusoidal pilot-tone, since the runner of the potentiometer is moved sinusoidal between a positive and a negative DC voltage at the extremities of the potentiometer. It will be clear now that the phase of both signals can be influenced only if the runners of the potentiometers are not in the mid position simultaneously. Since this is part of the construction, the phase difference in the SGB-60 series is fixed. The accuracy of the potentiometer has been chosen in such a way that a maximum phase deviation of 0.04 degree (0.01microsecond) is guaranteed.

This phase deviation cannot cause the channel separation to decrease further than 73dB! The guaranteed cross-talk of the SGB-60 is 60dB, so that deterioration of cross-talk as a result of phase shift, and laborious adjustments definitely belong to the past now.

It will be clear that the potentiometers used for the generation of the signals are not of conventional type. The potentiometer function has been achieved by means of a digital circuit, so all the problems of analog circuits such as instability, offset, etc. are avoided, presenting an adjustment-free, exchangeable module.

Each module is carefully tested before assembly in the SGB-60 series. Vibration tests and temperature shock tests (-20 to +90 degree Centigrade) are conducted with the module in operation, thus guaranteeing reliable performance.

One of the problems encountered in the design stage was, that no comparable equipment existed, nor the necessary tools to measure such specifications. Simultaneously with the development of the SGB-60 series, a number of completely new measuring techniques was devised, allowing the extraordinary qualities of the SGB-60 series to be checked by every user, having at his disposal a good oscilloscope and a tone-generator with low distortion. In the SGB-60 series manuals a separate chapter is dedicated to these measuring techniques.



### Channel separation

- G3-1 Channel separation from left to right . . . . >60dB ( $\geq 66$ dB typical)  
and vice versa in the frequency range  
from 30Hz – 15kHz.  
(Ref. +6dBm multiplex level, 600 ohm load, pre-emphasis off, pilot off)
- G3-2 Crosstalk from M to S and S to M . . . . . <45dB ( $\geq 60$ dB typical)  
(ref. 1kHz +6dBm, 600 ohm load, L and R equalized in level)

### Rejection of unwanted output frequencies

(Ref. +6dBm output level, coder in stereo mode, pilot on, input frequencies between 20Hz and 15kHz)

- G4-1 Rejection of all frequencies above 53kHz . >65dB  
G4-2 Rejection of the 38kHz subcarrier. . . . . >70dB  
G4-3 Influence of the specified values due  
to voltage variations between 190 and  
240V and ambient temperature variations  
between 5 and 50 degrees Celsius. . . . . <0.5dB

### Pilot-tone

- G5-1 Frequency . . . . . 19kHz  $\pm 0.5$ Hz  
G5-2 Amplitude . . . . . -9.5dBm (nominal)  
G5-3 Adjustment range of pilot amplitude. . . . -8 to -12dBm  
G5-4 Phase of the pilot-tone with respect to . . . 0 degree ( $\pm 0.04$  degree) (0.01 microsecond)  
the 38kHz subcarrier (equals >70dB phase cross talk)

### Harmonic distortion

(Ref. Harmonic distortion for input frequencies from 20Hz and 15kHz, output loaded with 600 ohm pre-emphasis off)

- G6-1 Input level left and right channel +6dBm . <0.03% ( $\leq 0.01\%$  typical)  
G6-2 As above, but with input levels of . . . . . <0.05% ( $\leq 0.02\%$  typical)  
+12.5dBm

### Intermodulation distortion according to DIN 45403

(ref.: Output level +6dBm, output loaded with 600 ohm. Input frequencies F1 (left) and F2 (right) between 20Hz and 15kHz. Frequency difference between F1 and F2: 1kHz. Measurement with spectrum analyzer)

- G7-1  $d_2 = \frac{U(F_1 - F_2)}{U_a \sqrt{2}}$  (2nd order product) . . . . . <0.01%  
 $d_3 = \frac{U(2 \times F_2 - F_1) + U(F_1 - F_2)}{U_a \sqrt{2}}$  (3rd order) <0.03%

### Intermodulation distortion in one channel according to SMPTE

(Ref.: On the left input a two-tone signal fa 250Hz, fb 9kHz, amplitude ratio 4:1. Input level +6dBm. Output loaded with 600 ohm. Reference output level +6dBm)

- G7-2 SMPTE-1M . . . . . <0.03% ( $\leq 0.01\%$  typical)

### Intermodulation with the pilot-tone according to DIN 45403

(Ref.: Input frequencies between 20Hz and 15kHz, f1 left channel, f2 right channel. Input level +6dBm. Coder in stereo mode, pilot-tone on, output loaded with 600 ohm. Reference output level +6dBm. Measured with spectrum analyzer in the frequency range from 20Hz to 100kHz)

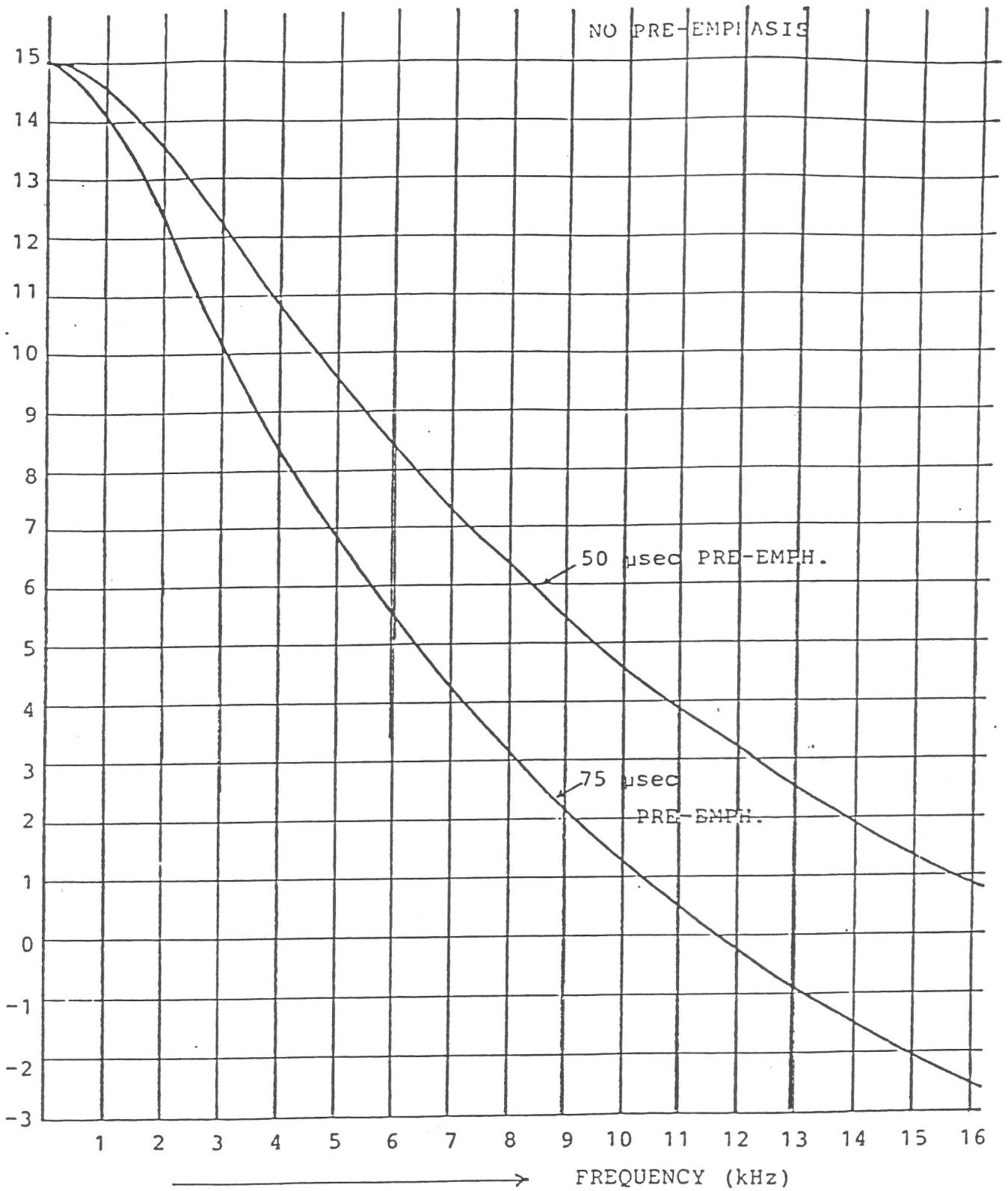
- G7-3  $d_2 = \frac{U(19 - f_1)}{U_a \sqrt{2}}$  (2nd order product) . . . . . <0.02%  
 $d_3 = \frac{U(38 - f_1) + U(2f_1 - 19)}{U \sqrt{2}}$  (3rd order) <0.03%

### Rejection of unwanted output frequencies in the S band

(Ref.: Coder in stereo mode, pilot-tone on, left and right input frequencies between 20Hz and 15kHz. Output level reference (peak value) +6dBm)

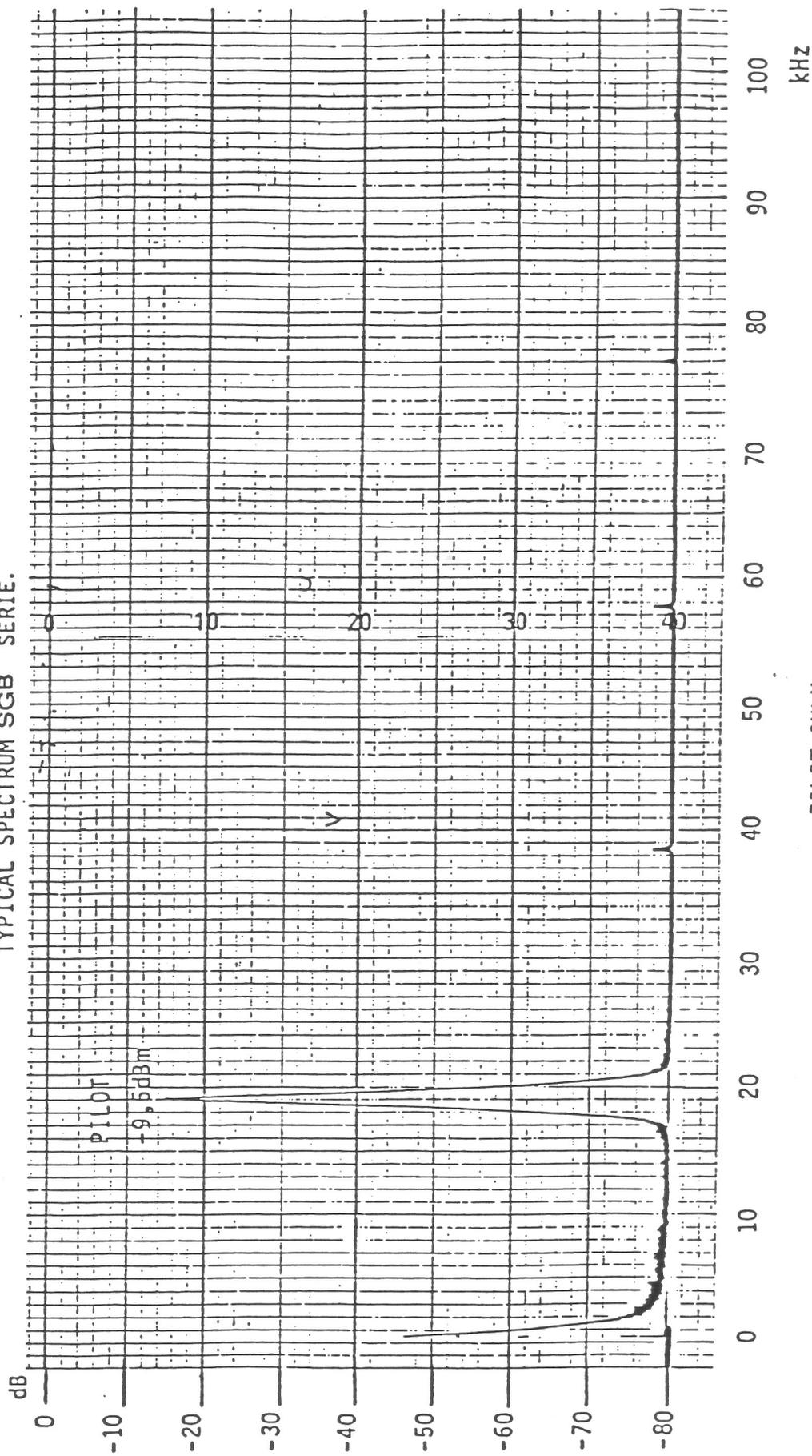
- G8 Rejection of unwanted signals with . . . . . >70dB  
respect to left + right, 19kHz and 38 + f1,  
38 - f1

MAX.  
INPUT  
LEVEL  
(dBm)



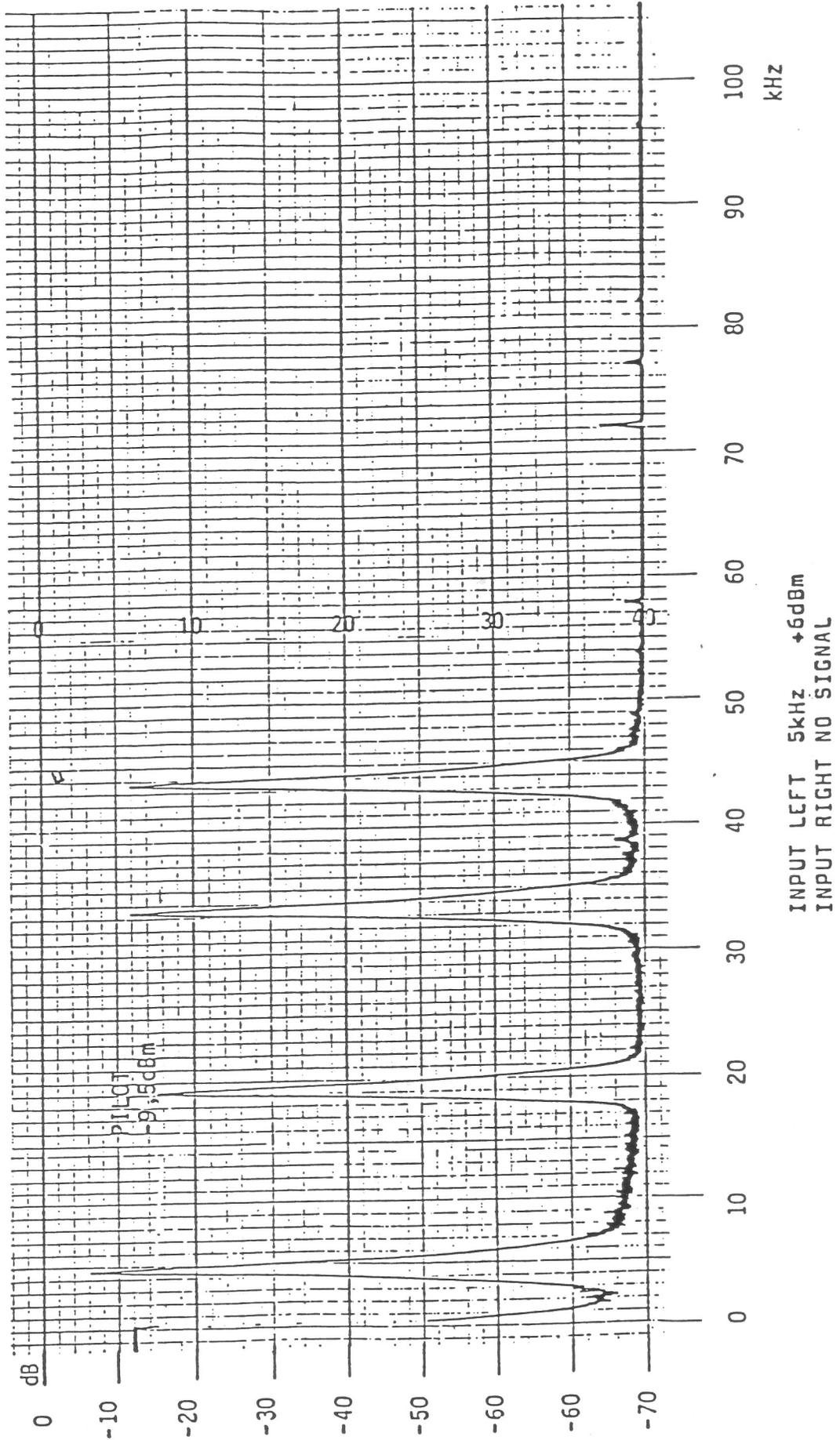
Maximum input levels for: no pre-emphasis  
50 microsec. pre-emphasis  
75 microsec. pre-emphasis.

TYPICAL SPECTRUM SGB SERIE.



PILOT ONLY  
INPUT LEFT NO SIGNAL  
INPUT RIGHT NO SIGNAL.

TYPICAL SPECTRUM SGB SERIE.



## SUMMING AMPLIFIER MODULE

See drawing A3-0679/23

Signals SHX and SHP coming from the sampling gates on the timebase module are stored by C1 and C6, and then buffered by amplifiers U1a and U1b.

C2 is provided to trim-out small time differences in zero crossing between the 38kHz sub-carrier and the 19kHz pilot tone.

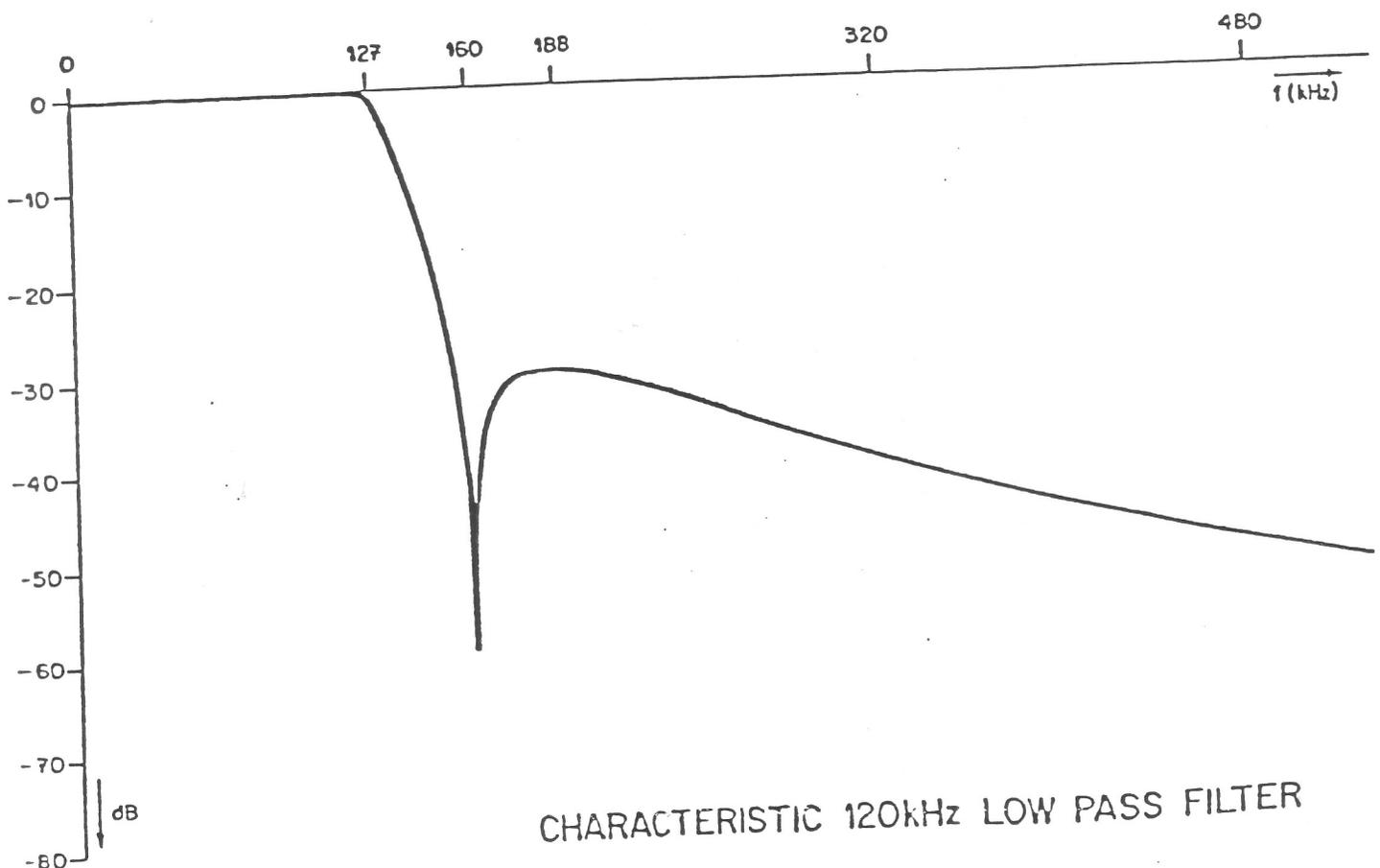
U2b is the pre-summing amplifier for the additional inputs. When no add. channels are used, it is recommended to open jumper J.P.1 in order to minimize noise pick-up.

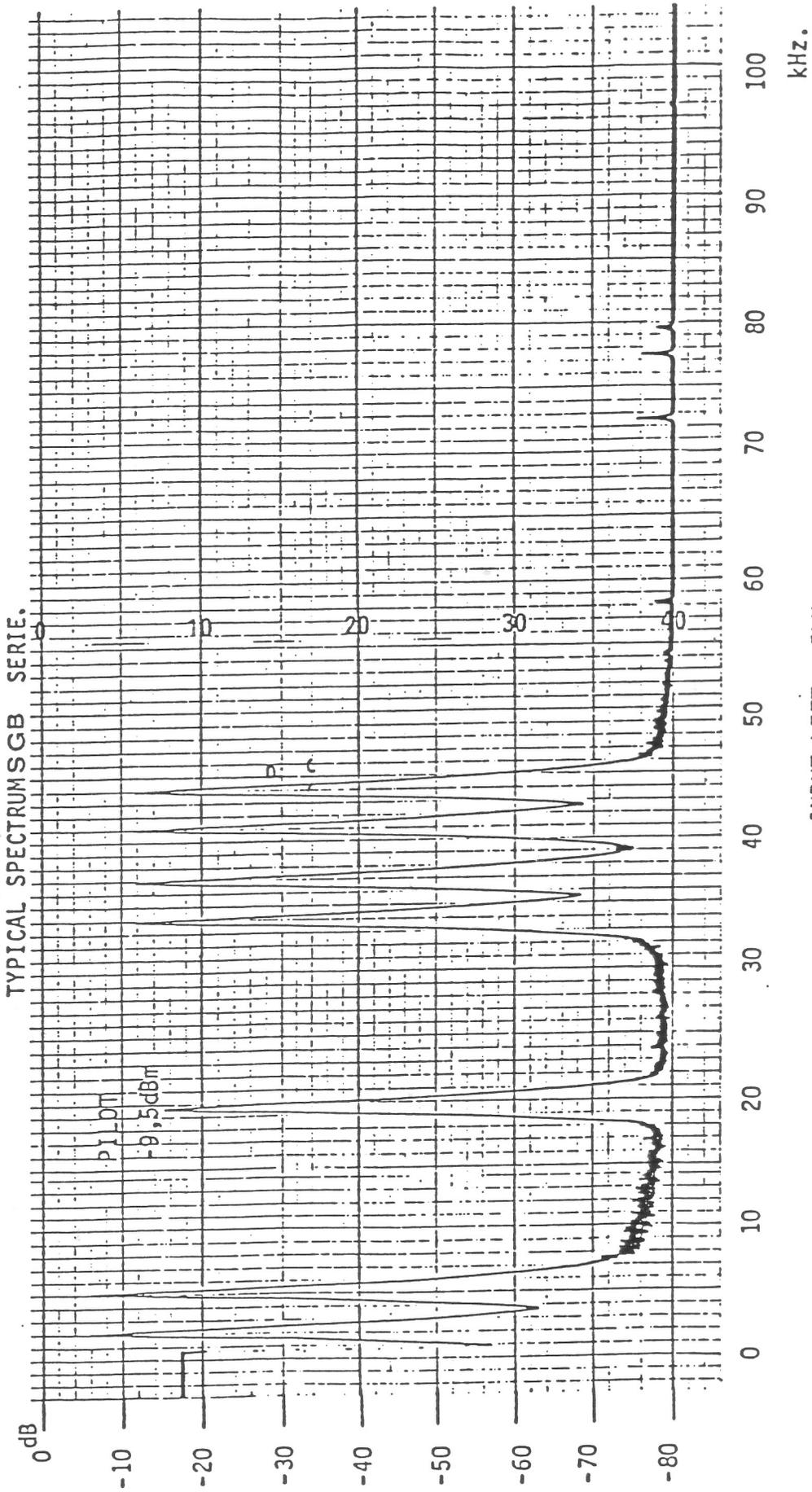
U2a is the summing amplifier for MPX pilot and add. channels. The output of this buffered amplifier goes to the 120kHz low-pass filter on motherboard 2.

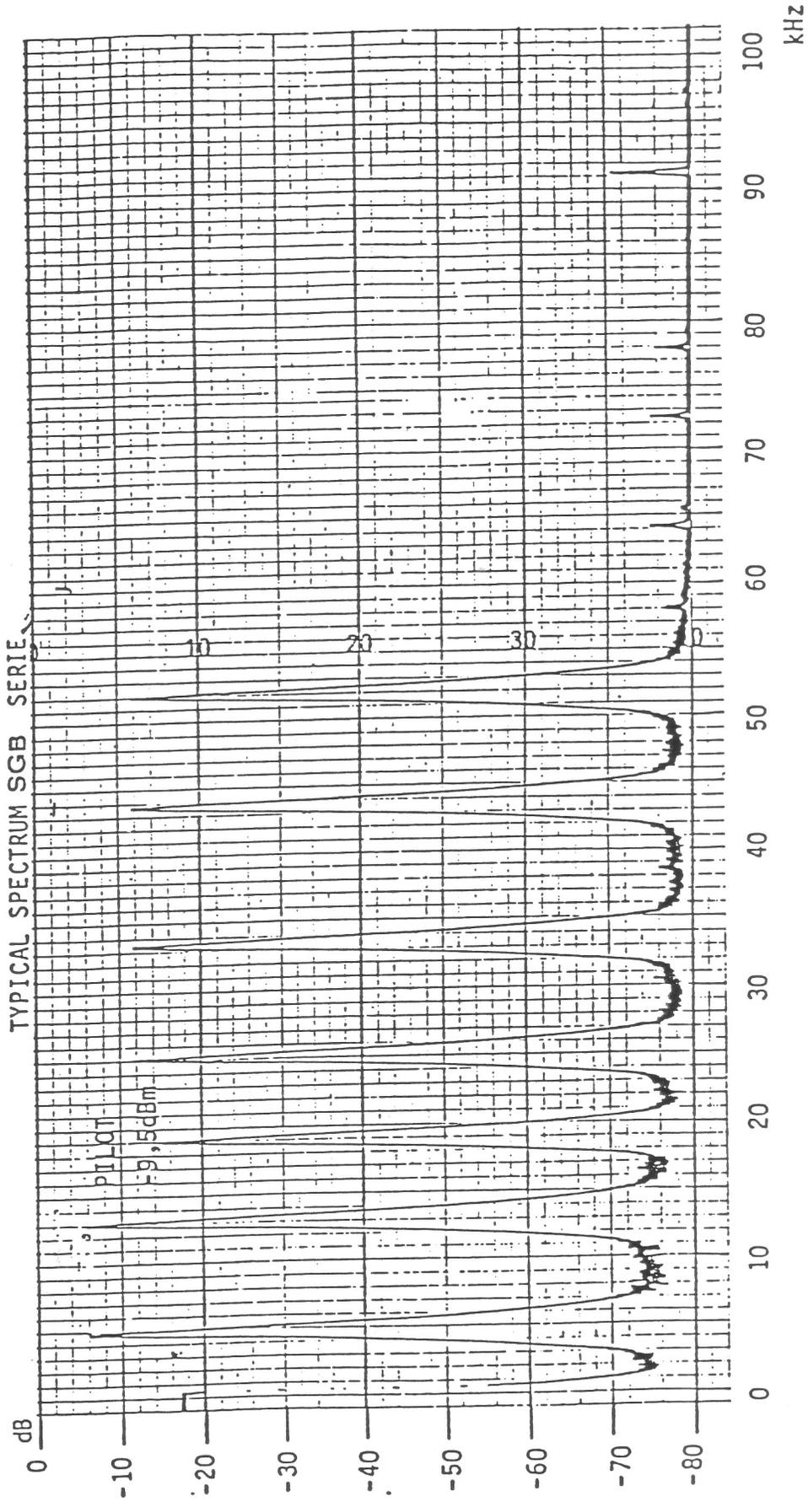
### 120kHz LOW-PASS FILTER

The purpose of this filter is to remove unwanted harmonics and noise above 100kHz, generated by the EPM modules, sampling gates and additional input signals.

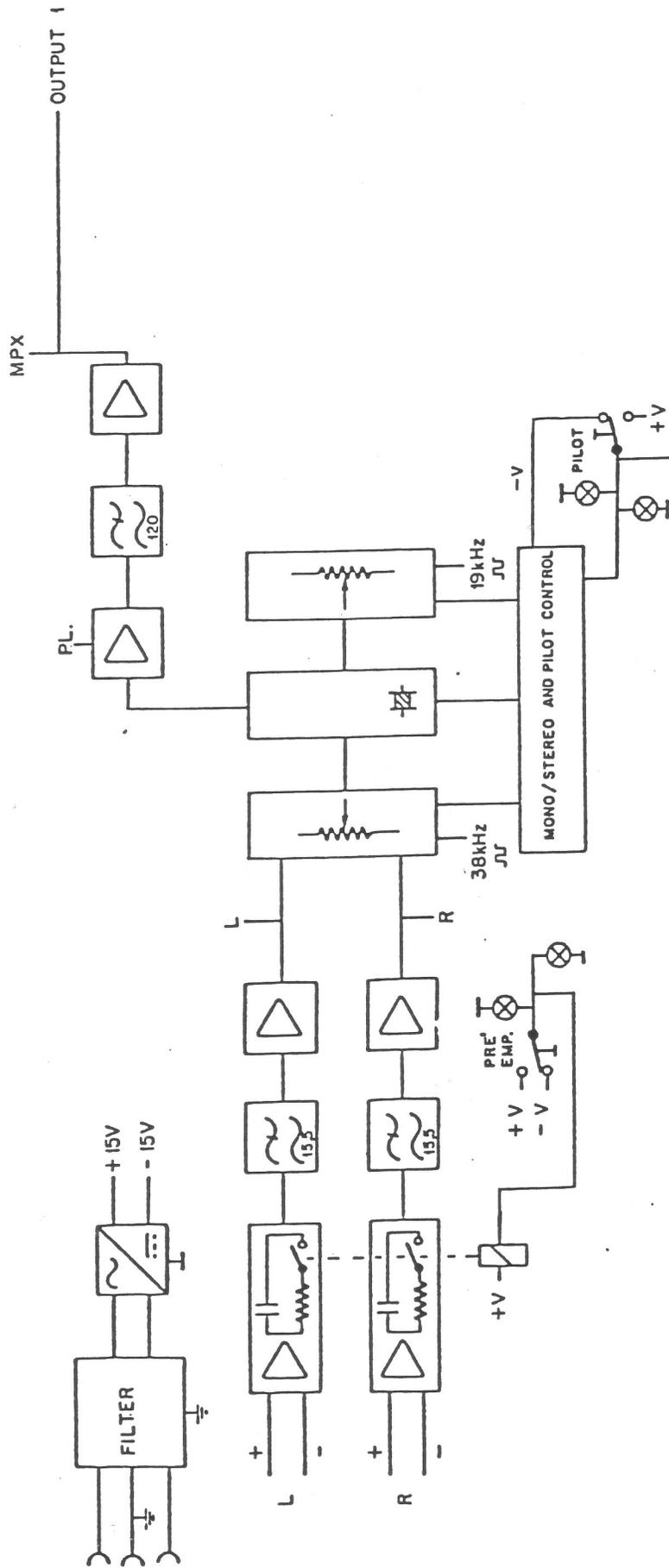
The filter is factory adjusted and needs no re-calibration. The case of a failure return the complete unit to the factory.







INPUT LEFT 5kHz  
INPUT RIGHT 13kHz +6dBm.



BLOCKDIAGRAM STEREOCODER SGB-60

GET: 16-01-1981						CORR:	
CORR	1	2	3	4	5	6	TEK.NR:
							A4-0181/01



Description of the blockdiagram SC204

Please refer to drawing A4-0181/01

Incoming left and right signals are buffered by a high-input impedance differential amplifier. Pre-emphasis is switched on by means of two relays and energized via the frontpanel switch "pre-emphasis". The L and R signals are then limited in bandwidth by two 15,5kHz low-pass filters.

Signal levels of +6dBm and a low impedance for the MPX electronic potentiometer are obtained by two buffer amplifiers. The electronic potentiometer is connected between both buffer-amplifiers, the runner of this potentiometer goes with a sinusoidal varying speed 38000 times per second from left to right and back.

The pilot potentiometer is connected between a plus and minus DC voltage and runs with a speed of 19.000 cycles per second.

Both signals are synchronized in frequency and phase on the timebase module.

Multiplex and pilotsignals are then added together with the pre-summed additional inputs and limited in bandwidth to 120kHz in order to remove all unwanted frequency components.

The filtered signal is then applied to both MPX output amplifiers.

The amplifiers can be connected as followers for dual unbalanced service, or as follower-inverter for single balanced operation; both outputs are short-circuit proof.

## INPUT AMPLIFIER MODULE

Refer to drawing A3-0679/15

U2 a and b are connected as voltage followers, this in order to make the common-mode rejection independent of the external source impedance.

U1 a is connected as a differential amplifier with a gain of 1, so the output level will be equal to the difference of the + and - inputs (nominal 6dBm).

C6 in parallel with R10 is responsible for the pre-emphasis characteristic.

Pre-emphasis is switched on when the cathode of CR1 is at -15 Volt level.

The output of U1b is connected to the 15kHz low-pass filter on motherboard 2.

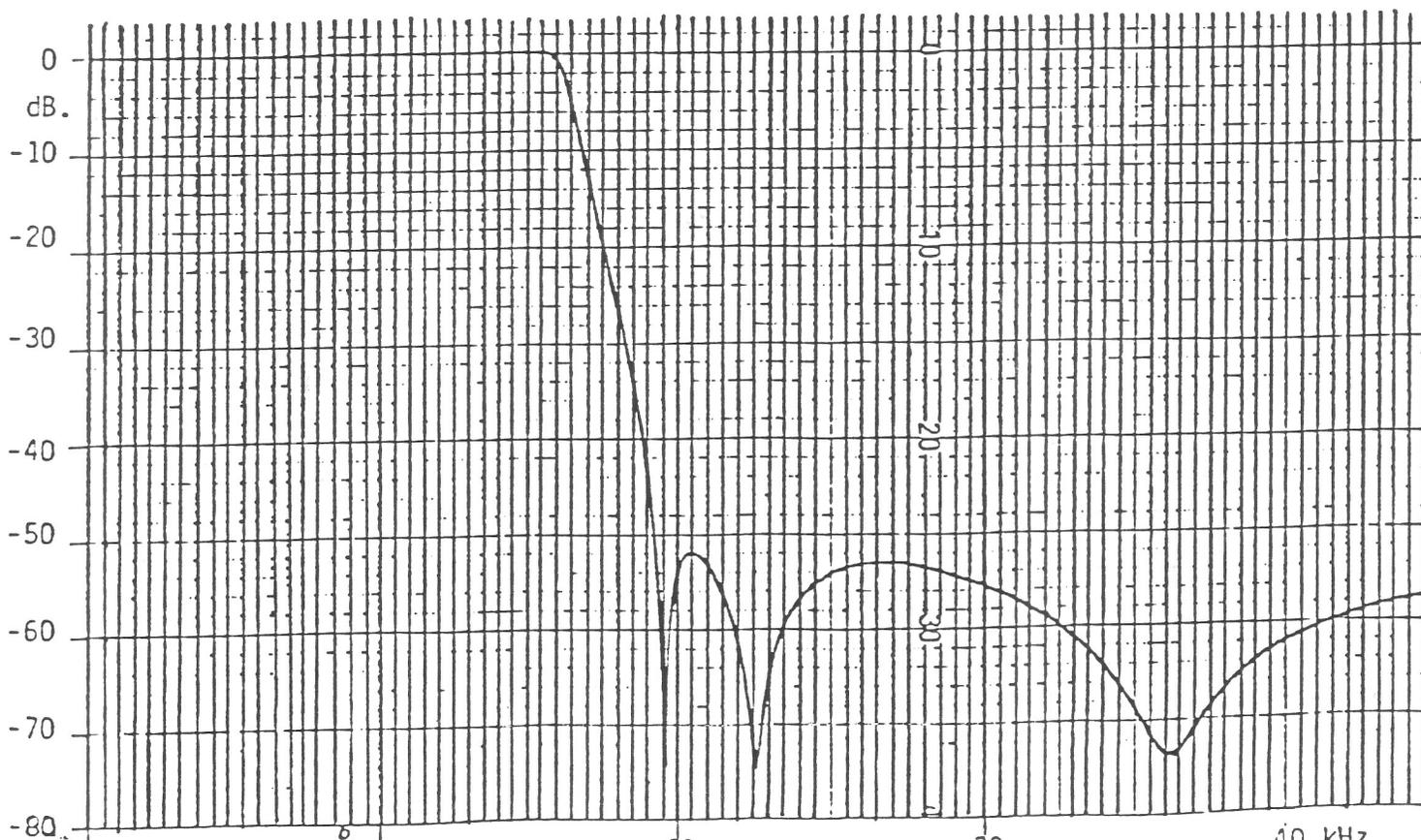
In the SGB 60 the gain of this amplifier can be adjusted with the level potentiometers for L and R located on motherboard 1.

In the SGB 60 the gain is adjusted by means of a switchable resistor network located on the input function PCB, in this case potentiometers R3 and R4 are removed from the motherboard.

## 15kHz LOW-PASS FILTERS

Filters are factory adjusted and need no re-calibration.

In case of a failure it is recommended to return the complete unit to the factory.



## BUFFER AMPLIFIER MODULE

See drawing A3-0679/17

The buffer amplifiers are necessary

to compensate for the 6dB loss in amplitude of the 15kHz low-pass filters, and to provide a low source impedance for the multiplex EPM module.

Signal coming from the 15kHz LP filter is AC coupled to the + input of U1 and then amplified by a factor of 2.

A very small part of the other channel is fed into the - input of U1; this to optimize the channel separation.

The right channel buffer-amplifier is provided with an offset-control potentiometer, this to make the DC voltage over the MPX potentiometer as low as possible and consequently to minimize the 38kHz sub-carrier rest.

Amplifiers U1 of the left and right buffers are a matched pair selected on offset-drift versus temperature.

EPM 2020

See drawing A4-0680/07

This unit contains a high precision electronic potentiometer. The total resistance between L and R is 2020 ohm.

The module needs no calibration.

The multiplex EPM is equal to the Pilot EPM.

The 532kHz inputclock is generated by the time based module.

A high level on "set" forces the runner of the potentiometer to the L position, this is done in the mono mode.

A high level on CE disables the inputclock. This is only used on the Pilot EPM to let this one run at 266kHz.

The logic levels are high  $+7V \pm 1V$   
low  $-7V \pm 1V$

## TIME BASE MODULE

See drawing A3-0679/22

The time base generates the 532kHz clock for both EPM modules; and samples the output signal of these modules.

In the mono mode of operation the compensation for maximum channel separation is switched of via switch A of U1.

U2a is connected as a parallel-resonant crystal oscillator with a frequency of 5320kHz.

U3 divides this frequency by a factor 10, down to 532kHz.

Logical levels are high =  $+7V \pm 1V$   
low =  $-7V \pm 1V$

### Pilot control

Part of motherboard 1 - see drawing A3-0680/21

#### Function:

- a) slow increase and decrease of the pilot amplitude during mono-stereo or stereo-mono switching, in order to prevent switching clicks.
- b) delayed switching stereo to mono when the pilotlevel has become sufficiently low.

#### Description:

After switching the pilot to the on-position the top of potentiometer R36 goes from zero volts to about -14,4 Volt. Because C7, the output of U1a goes slowly from 0 to about +5 Volt, depending on the setting of the pilotlevel potentiometer R36.

The output of U1b will follow in opposite polarity. Connection to this control goes via connector J1.

When the pilot is switched off (mono mode) the voltage between PA+ and PA- goes slowly back to zero. This level can be made as low as possible with potentiometer R27 "PA zero".

U2a is acting as a comparator, when the coder is switched to mono, pin 3 of U3 goes to +15mV, in between time PA+ goes down and when this level becomes lower than +15mV the output of U2a goes high and sets the digital logic to the mono mode of operation.

In the SC203, the pilotlevel control R36 is removed and replaced by a frontpanel-pilotlevel-control.

MPX output amplifiers

See drawing A3-0679/19

This circuit contains two identical stages of an operational amplifier buffered with a complementary pair of emitter-followers in the feedbackloop in order to increase the output current.

Output current is limited to approx. 70mA by the combination of the 13ohm emitter resistors and the two diodes between base and output.

Both output stages can be connected as followers for dual-unbalanced output mode, or the second stage can be connected as inverter after the first stage for balanced output mode. In this case the level of both outputs can be increased by 6dB by connecting R14 to common (soldering point).

In the dual output mode, the gain of the second amplifier can be increased by connecting R12 to common; connection between R12 and output of the first stage should be opened.

## Calibration procedures.

Note. Scheduled calibration is not necessary because of the use of high quality components like:

- fet-input operational amplifiers
- silvered mica capacitors
- metalfilm resistors
- sealed multiturn potentiometers
- and last but not least the unique method of absolute in-phase pilot tone generation.

Calibration is necessary after replacement of the following parts:

	<u>re-adjust</u>
a) voltage regulators U2 and U5	2b, 5a
b) buffer amplifiers	2a
c) on time base module: U1 (4066)	7, 2c
d) on time base module: U2 (4060)	3
e) on summing amplifier module: U1, U2	7, 2c
f) on motherboard 1 : U1	2b
g) on motherboard 2 : U4	2c
h) potentiometers and trimmers: the replaced part	

## 6) S to M Separation

Mode: stereo, pilot off, pre-emphasis off.

Input 1kHz +12dBm to L and R in opposite phase. Slightly adjust "gain right" for a minimum 1kHz component on MPX output; measured with a selective voltmeter or a spectrum analyzer.

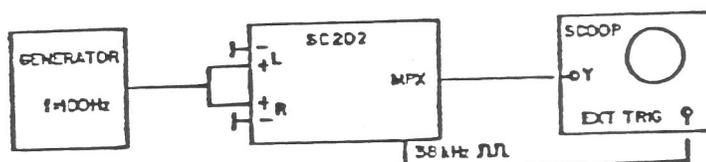
When no selective measuring device is available: input 1kHz +12dBm in phase to L and R, connect an AC millivoltmeter with floating inputs between the left and right buffer outputs and slightly adjust "gain right" for a minimum indication.

## 7) Pilot Phase

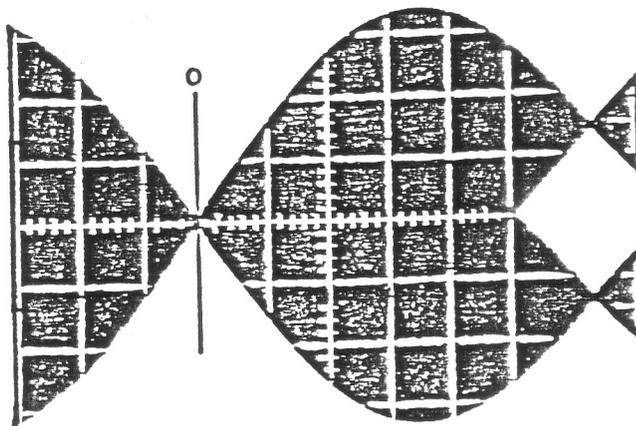
Note: Because the unique way of pilot tone generation; synchronous and in-phase, this very fine adjustment is only necessary after replacing the sampling gates CD 4066 or the holding amplifiers (summing ampl. module). This adjustment compensates for small differences in time delay of these components.

Mode: stereo, pilot on, pre-emphasis off.

Input 100Hz - 10dBm in opposite phase, trigger scope via a 10:1 probe on the 38kHz synchronisation point, probe groundclip to common.

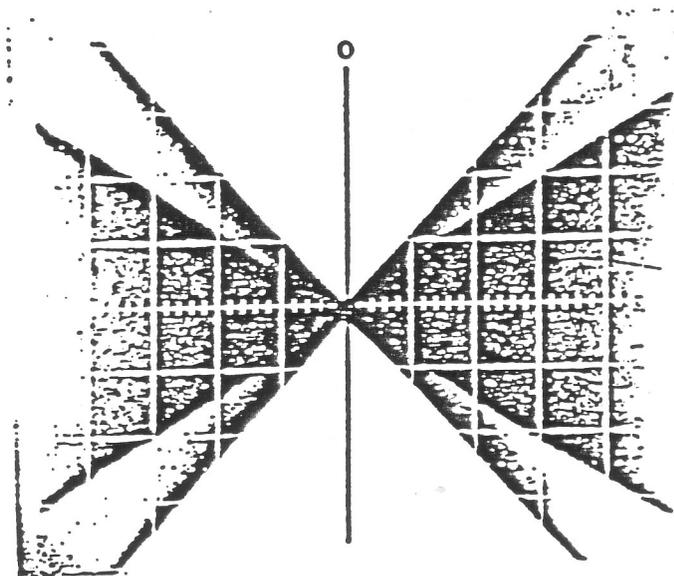


Adjust oscilloscope to obtain this picture:



Timebase 2 microsec/div. use trigger-holdoff.  
Vertical input DC coupled.

Use delayed trigger mode to obtain this picture:



Time base B to 50 nsec/div.  
Vertical sens. 5mV/Div.

Adjust C2 on summing amplifier so that all lines are going through the same point.

8) L - R channel separation

This adjustment can be done in two ways:

1. With a high quality stereodecoder like the Tratec SMD 203  
-Holland-
2. With an oscilloscope having a flat amplitude and linear phase characteristic of more than 53kHz and also to be overdriven by a factor of 125 without distortion of the signal on the screen.  
Rood's Q.A. dept. is using the Tektronix 547 with a 1A1 plug-in for this purpose.

## 8) a. With the SMD 203.

Connect the SGB 60 MPX output to the input of the SMD 203.

Input 1kHz +6dBm to left

Short right input

Adjust "sep left" for max. separation

input 1kHz +6dBm to right

Short left input

Adjust "sep right" for max. separation.

## b. With the oscilloscope.

Generator 1kHz +7dBm output level, connect output also to ext. trigger input of the oscilloscope.

Connect MPX output to scope vert. input

Set scope to D.C. mode

Set scope to 5mV/Div.

Jumper the SGB-60 for +6dBm unbalanced output level.

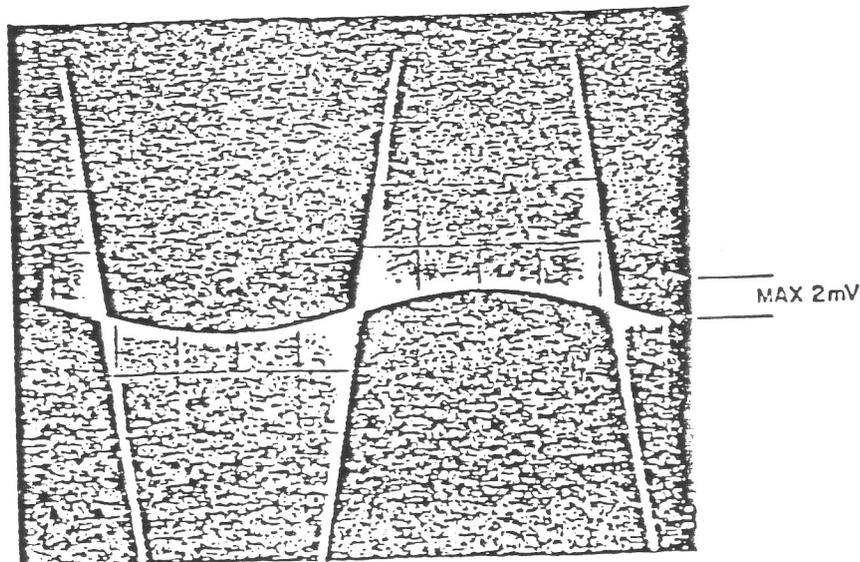
Connect generator to left input

Short right input.

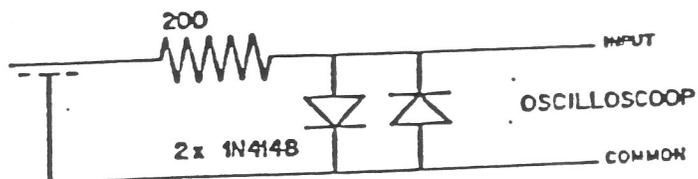
Adjust "Sep.L" to obtain conditions as in figure.

Connect generator to right input  
Short left input

Adjust "Sep.R" to obtain conditions as in figure.



Overload symptoms of the oscilloscope can be reduced by this circuit:



to be connected direct on oscilloscope's input.

Trouble shooting

First look to the frontpanel indicators!

All led indicators are dark:

- Check the incoming AC line voltage
- check fuses

Part of led indicators are dark

- use the pre-emphasis switch to check the internal + and - 15 Volt supply;
- the pre-emphasis ON led to check the - 15 Volt
- the pre-emphasis OFF led to check the + 15 Volt

Left of Right channel missing on the MPX output

- coder does not receive an input signal

Check the input amplifier, low-pass filter interconnecting cables and buffer amplifier.

If there is signal, the problem can be a defective multiplex EPM or a failure in the cristal oscillator or divider.  
In this case the pilottone is also abcent.

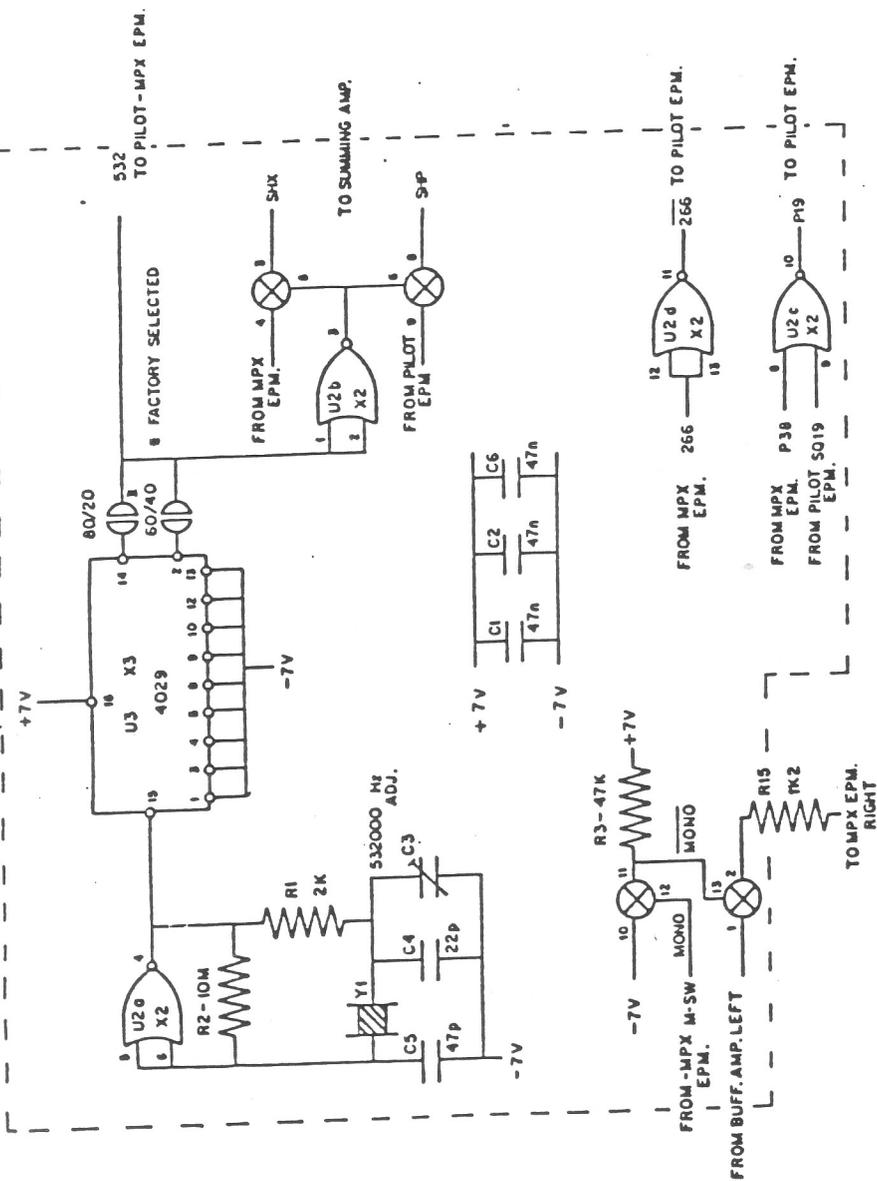
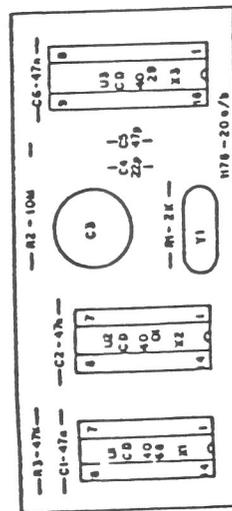
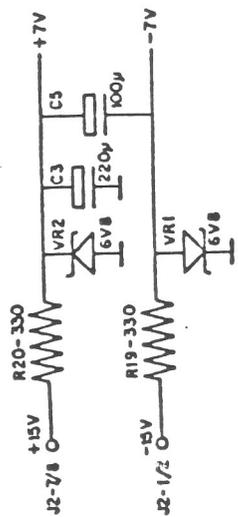
Dismantling the SGB-60

Remove the crews of the top and bottom cover.  
Look for disconnected cables and broken wires.  
Push all flatcable connectors in their sockets.

Power supply

Check for plus and minus 15 Volt ( $\pm 0,5V$ ); supply voltage over C10 and C9 on the summing amplifier module.  
Use the minus side of C9 as common.

Check for plus and minus 6,8 Volt ( $\pm 1$  Volt) between common and pins 14 and 7 of the CD 4066 on the timebase module.



TIMEBASE MODULE A3-7 SGB-60



GET: 17-05-1979

CORR: 19-01-1981

CORR:  2 3 4 5 6

TEK.NR:

A3-0679/22

Pilottone is missing

- pilottone is switched OFF
- defective time base oscillator or divider. In this case the MPX signal is also not generated but produces a sum signal of left and right with a ratio dependent on the runner position of the multiplex electronic potentiometer
- defective cable from frontpanel to motherboard 1
- defective pilotcontrol circuit
- defective pilot EPM
- defective MPX EPM.

Pilottone out of phase more than 700 nsec.

- defective CD 4001 on the time base module
- defective MPX EPM
- defective Pilot EPM.

Pilottone out of phase less than 700 nsec.

- defective CD 4066 on time base module
- disconnected holding capacitor on summing amplifier module.

Strong 38kHz component in MPX signal

- defective buffer amplifier
- defective offset control potentiometer on buffer amplifier module.

The DC level between the L and R inputs of the MPX EPM should be zero  $\pm$  1mV max.

19kHz pilottone does not disappear completely when pilot is switched off

- defective amplifier U1 of the pilotcontrol circuit
- defective diode CR8 on frontpanel; check for OV on J3 -11 when the pilot is switched off.

The DC level between PA+ and PA- should be zero  $\pm$  1mV max. After replacement of U1 re-adjust R 36 - PA zero for minimum 19kHz.

Bad channel separation in both channels

- The oscilloscope used for this measurement was AC coupled or overdriven.
- There is no pilottone, or the pilottone is out of phase due to a defect.
- Shorted coil or open capacitor in the 120kHz low-pass filter
- Open or disconnected C1, C2, C6 on the summing amplifier module.

## Function of the signals:

- 532 : clock for both EPM modules  
note: the clock for the pilot EPM is delayed by R and C51.
- sample : control signal for both sampling gates.
- SQ 19 : Squarewave signal from the pilot EPM used to select every second P38 pulse. This signal is also divided by R38 - R39 to obtain the 19kHz - 1Volt synchronization output.
- P38 : Pulse from the MPX EPM every time the runner reaches the left channel position.
- P19 : selected puls of P38 and used to bring the 19kHz pilot tone in the correct phase.
- 266 : half the clock frequency
- $\overline{266}$  : clock enable to let the pilot EPM run at half speed of the MPX EPM
- SHP : pilot tone synchronized by the sampling gate
- SHX : multiplex signal synchronized by the sampling gate
- 38kHz : squarewave of 38kHz divided by R16 - R17 down to 1 Volt.

If all digital signals are correct, proper operation of the MPX EPM can be checked on the following way:

- 1) mode: stereo, pilot off  
short all inputs
- 2) connect a 4½ volt battery between pin 3 of both buffer amplifier modules (connect to C3 as indicated on drawing)

Check the MPX output of the coder for a clean 38kHz signal.  
If wrong replace the MPX EPM.

Bad channel separation in one channel

- defective potentiometer Sep. L or Sep. R.
- when only the left channel is bad: defective CD 4066 on the timebase module.

Wrong frequency of pilot tone and sub-carrier

- defective divider CD 4029 on timebase board
- defective crystal
- defective capacitors in crystal oscillator circuit
- in case of a small error first calibrate the frequency counter, then adjust C3 on the time base module.

High DC component on MPX output

- defective amplifier U1 or U2 on summing amplifier module, or defective potentiometer R8.
- defective amplifier U4 on motherboard 2.

High level of harmonics in stereo mode

- Defective CD 4066
- Unused MPX output shorted or defective
- Defective Pilot EPM
- Defective MPX EPM
- Defective buffer-amplifier module; check the output of the buffer amplifiers for a clean signal.

Testing the EPM modules

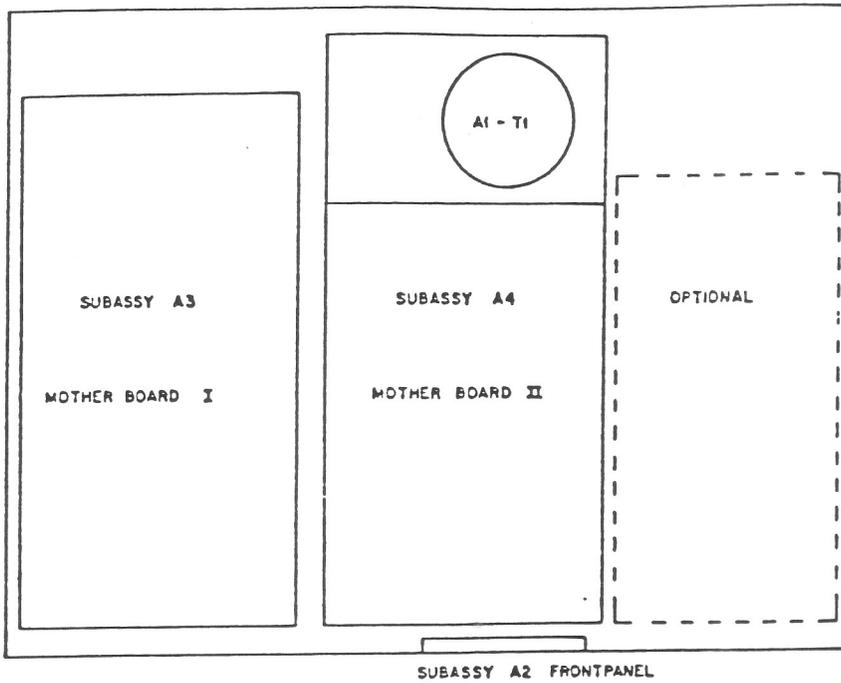
In case of problems, first check the supply voltages. If the + or - 6,8V ( $\pm 1V$ ) is too high, replace zener diodes VR1 or VR2. If too low, replace U1, U2 and U3 on the timebase module. If still too low, check all capacitors connected to the 6,8 Volt circuit before removing the EPM modules.

Note: the polarity of C8 is marked wrong on the rearside of the motherboard.

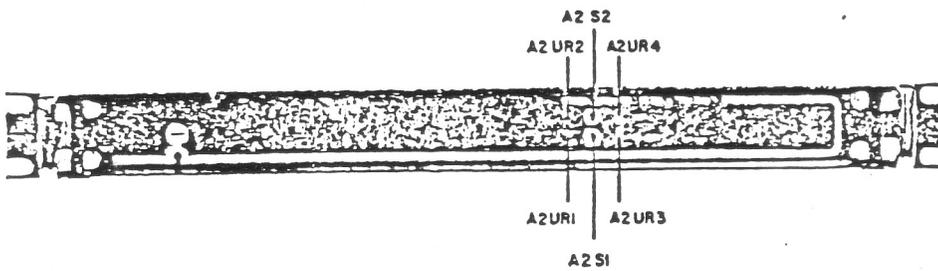
In case of a malfunction with correct  $\pm 6,8V$  supply voltages, first replace U1, U2 and U3 on the timebase module. If this does not help, please refer to the timing diagram and check the mentioned signals; trigger the oscilloscope on the positive edge of SQ 19.

Logic zero and one levels are equal to the  $\pm 6,8V$  supply voltages, except for the 38kHz signal available on the rear side of the motherboard; this level is about 1V pp. Special attention should be paid to the signals P38 and P19; these pulses are very short and therefore difficult to see on the screen.

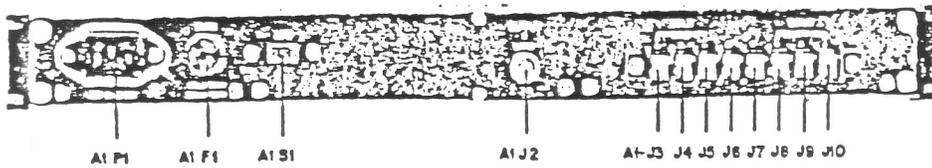
TOP VIEW



FRONT VIEW



REAR VIEW



**SGB-60**

**Tratec**  
Holland

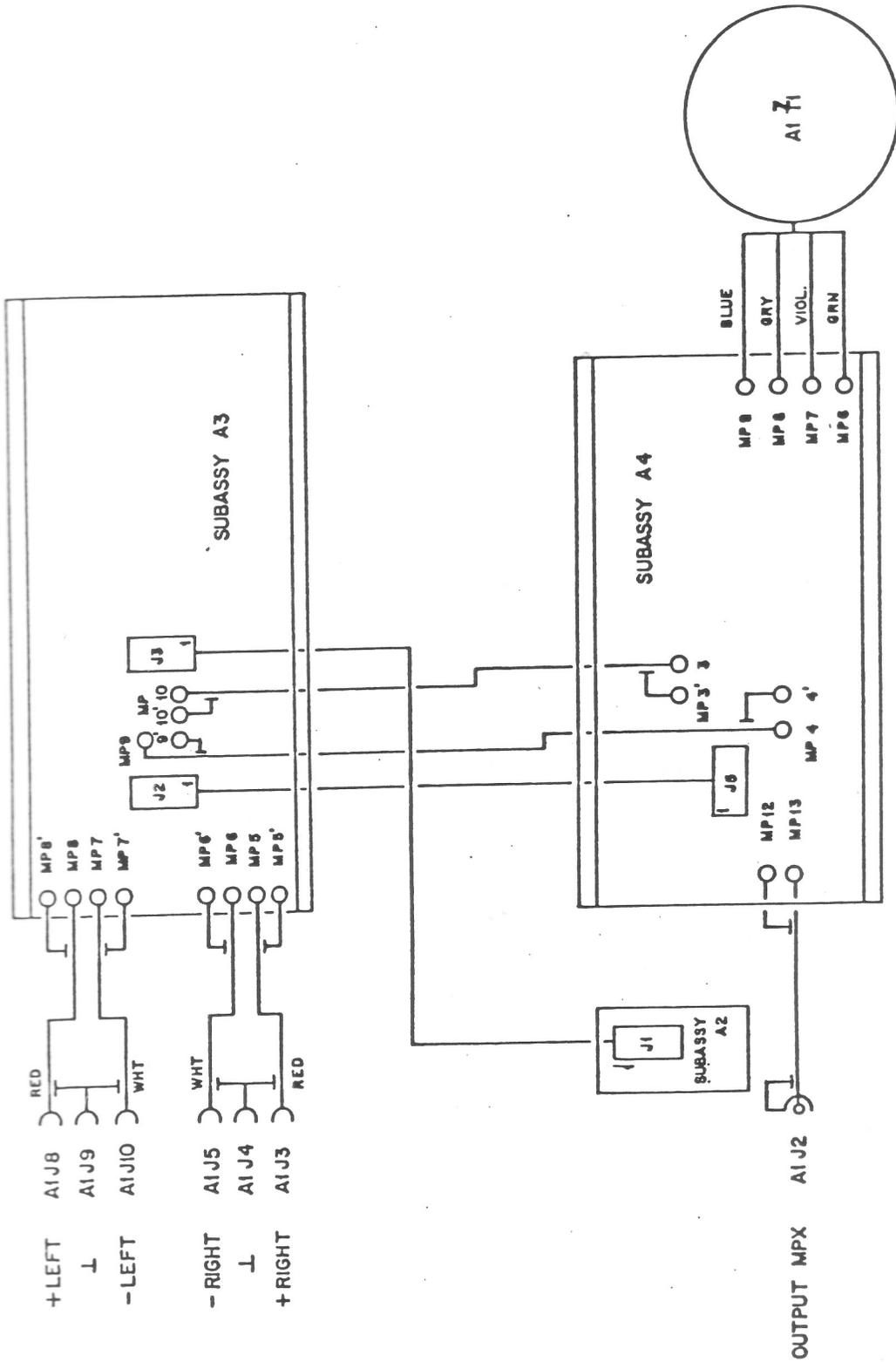
GET: 02-10-1981

CORR :

CORR 1 2 3 4 5 6

TEK.NR:

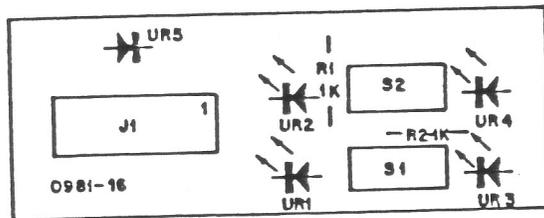
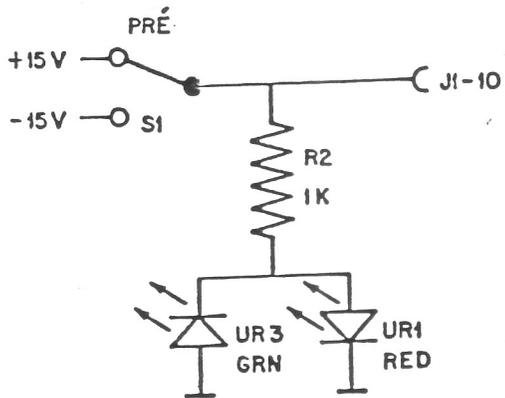
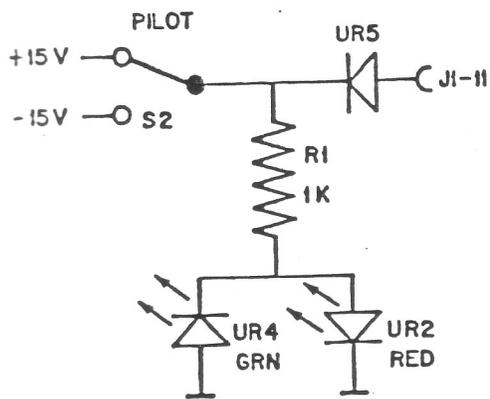
A3-1081/51



WIRING DIAGRAM SGB - 60

GET : 29-09-1981						CORR :	
CORR	1	2	3	4	5	6	TEK.NR :
							A4-098/19





J1-9 = +15V  
 J1-16 = -15V ——— J1-14

FRONTPANEL SGB - 60 SUBASSY A2

**Tratec**  
 Holland

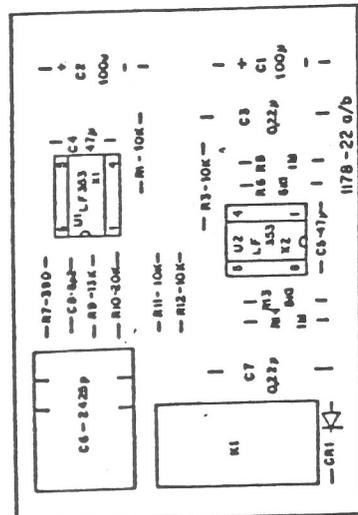
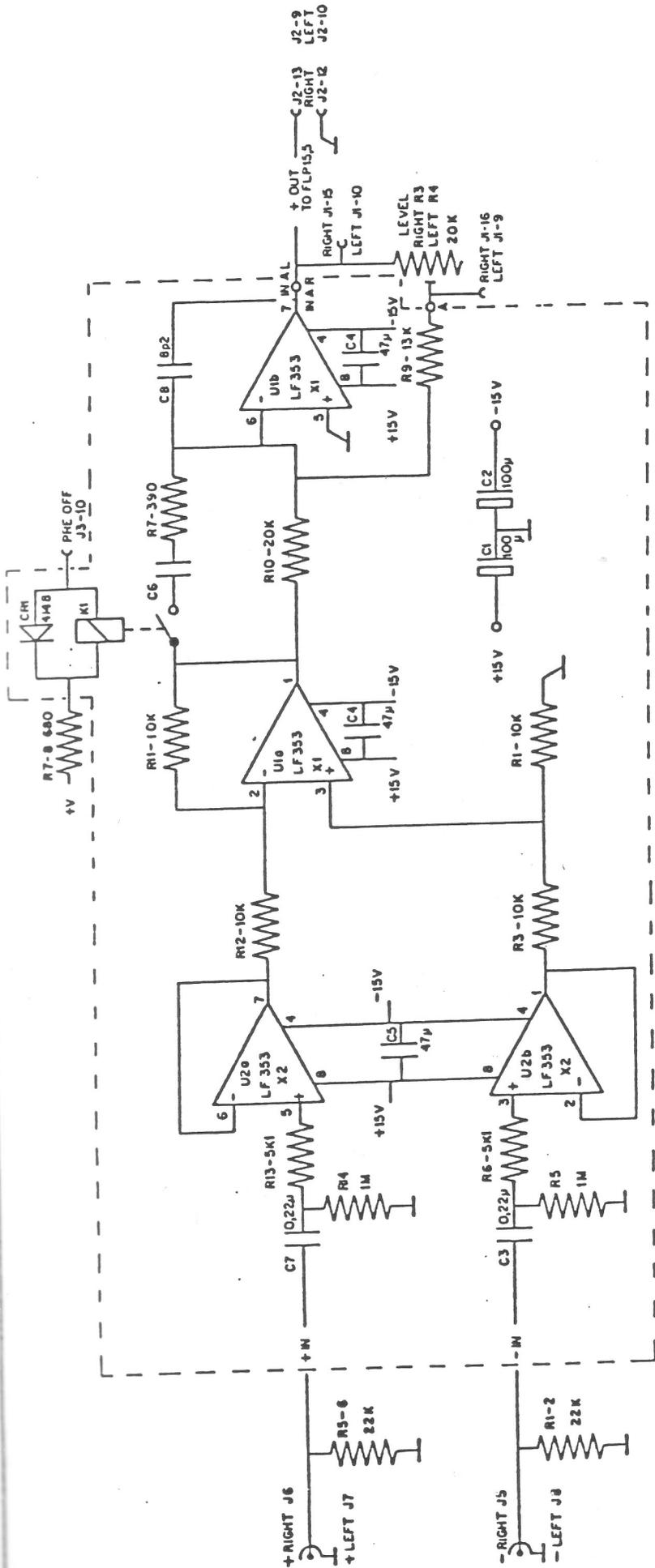
GET: 09 - 09 - 1981

CORR:

CORR: 1 2 3 4 5 6

TEK.NR:

A4-0981/18



INPUT AMPLIFIER A3-1;2 SGB-60



GET: 17-05-1979

CORR: 19-01-1981

CORR: 2 3 4 5 6

TEK.NR:

A3-0679/15

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITY	MANUFACT.
<u>3001 CAPACITOR</u>				
C 1	220pF STYRO	A-196	1	ERO
C 2	10-40pF TRIMMER	A-177	1	PHILPS
C 3+4+6+7	47nF CER. DISC. 30V	A-233	4	CRL
C 8	270nF POLYESTER 63V	A-245	1	ERO
<u>3001 B. ZILVERMICA</u>				
C 5	300pF		1	P.I.
<u>3001 D. ELECTROLYTIC</u>				
C 9+10	100µF AXIAL 25V	B-80	2	PHILPS
<u>3002 CONNECTORS</u>				
MP 1+2	TERMINAL 1 POLE CERAMIC	672	2	DRALORI
X 3+4	SOCKED 8 P. DIL. LOW	1-83	2	
<u>3004 A. DIODE</u>				
CR 1/6	SIL 1N4148	1-18	6	FAIRCH.
<u>3004 E. TRANSISTOR</u>				
Q 3	BC 179c PNP SIL TO18	1-50	1	PHILPS
Q 4	BC 109c NPN SIL TO18	1-09	1	PHILPS
<u>3004 H. OP-AMP</u>				
U 1+2	LF 353 BN DUAL	D-12	2	NATION
<u>3011 P.C. BOARD</u>				
MP 5	PRINT : SUMMING AMPLIFIER 1178-26a/b		1	ROOD BV
<u>3016 RESISTOR</u>				
R 2	3K9 OHM METALFILM 0,3W 1%	A-74	1	CRL
R 3	270 OHM METALFILM 0,3W 1%	A-46	1	CRL
R 4+6+7+11+ 12+15	5K1 OHM METALFILM 0,3W 1%	A-77	6	CRL
R 5	5K6 OHM METALFILM 0,3W 1%	A-78	1	CRL
R 9	510 OHM METALFILM 0,3W 1%	A-53	1	CRL
R 10	330K OHM METALFILM 0,3W 1%	A-120	1	CRL
R 13+14	15 OHM METALFILM 0,3W 1%	A-16	2	CRL
<u>3016 B. POTMETER</u>				
R 1	1K OHM RECTANGULAR MULTI-TURN	A-311	1	DALE
R 8	50K OHM RECTANGULAR MULTI-TURN	A-321	1	DALE

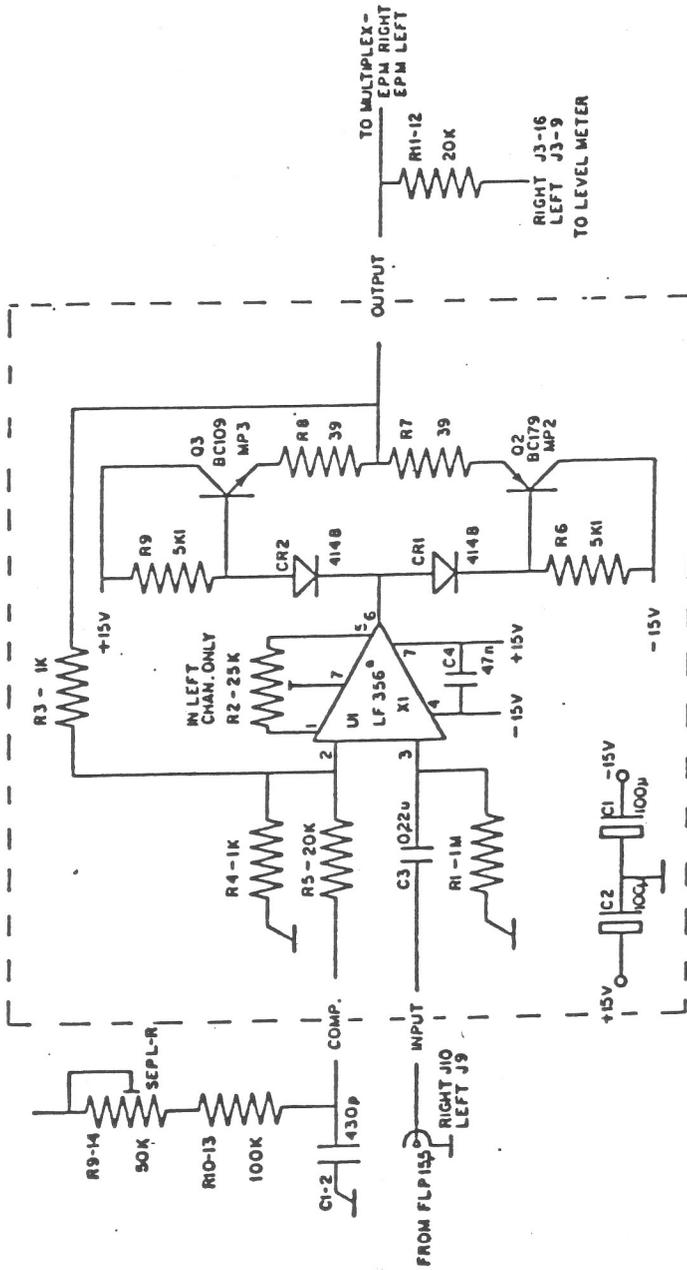
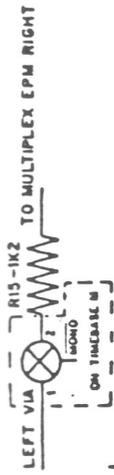
NOTES:

SUMMING AMPLIFIER SGB - 60

**Tratec**  
Holland

WRITTEN ON: 30-6-80	PAGE 1 OF 1 PAGES
CORR: 12-5-82	BELONGS TO DRAWING:
REFRESHMENT: ECJ.W	A3-0679/23

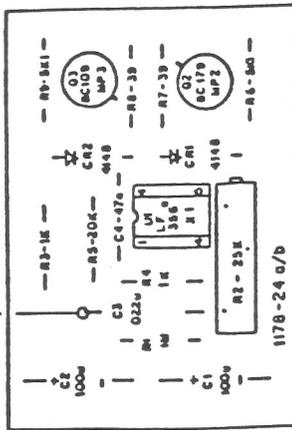
RIGHT TO MULTIPLEX EPM LEFT



TO MULTIPLEX-  
EPM RIGHT  
EPM LEFT

R11-12  
20K

RIGHT J3-16  
LEFT J3-9  
TO LEVEL METER



# BUFFER AMPLIFIER A3-3;4

GET: 20-02-1979

CORR:

CORR 1 2 3 4 5 6

TEK.NR:

A3-0679/17

CLOCK 532  
U2-1

SAMPLE  
U2-3

S019  
U2-9

P38  
U2-8

P19  
U2-10

38 kHz

266  
U2-12

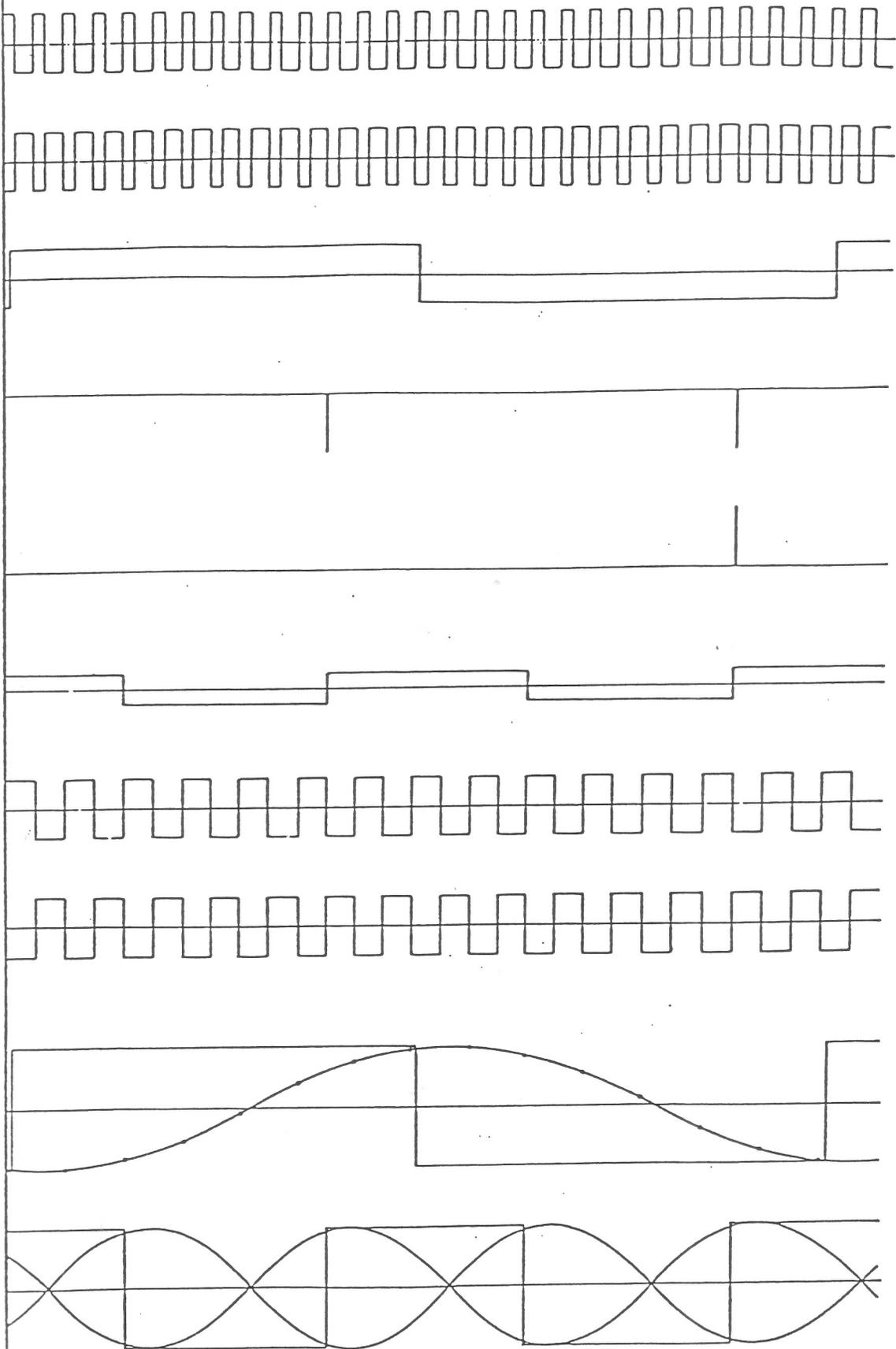
266  
U2-11

S019

SHP

38 kHz

SIX



ALL SIGNALS ARE  
MEASURED ON THE  
TIMEBASE MODULE

SEE DRAWING  
A3-0679/22

TIMINGDIAGRAMM

SGB - 60

**Tratec**  
Holland

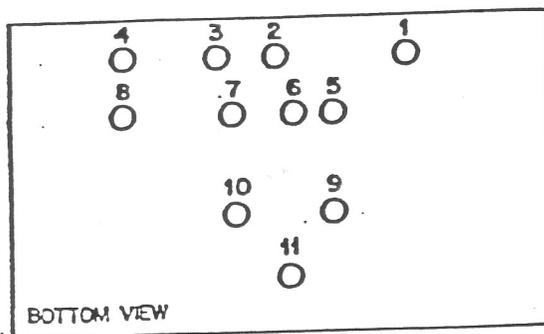
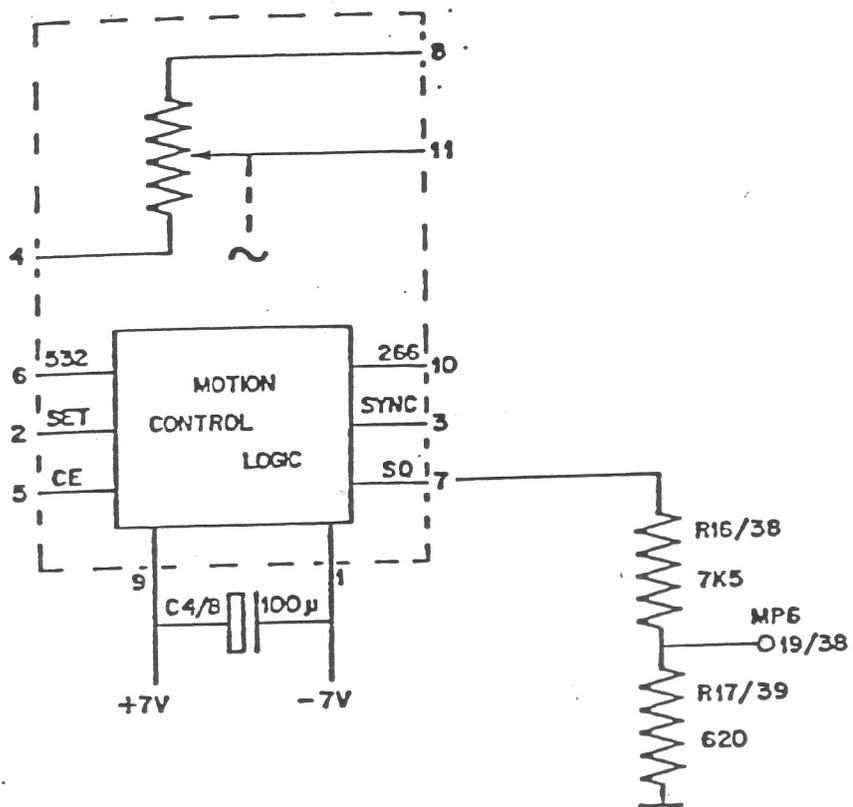
GET : 03-07-1980

CORR:

CORR 1 2 3 4 5 6

TEK.NR:

A4-0780/09



ELECTRONIC POTENTIOMETER MODULE A3-6;8

**Tratec**  
Holland

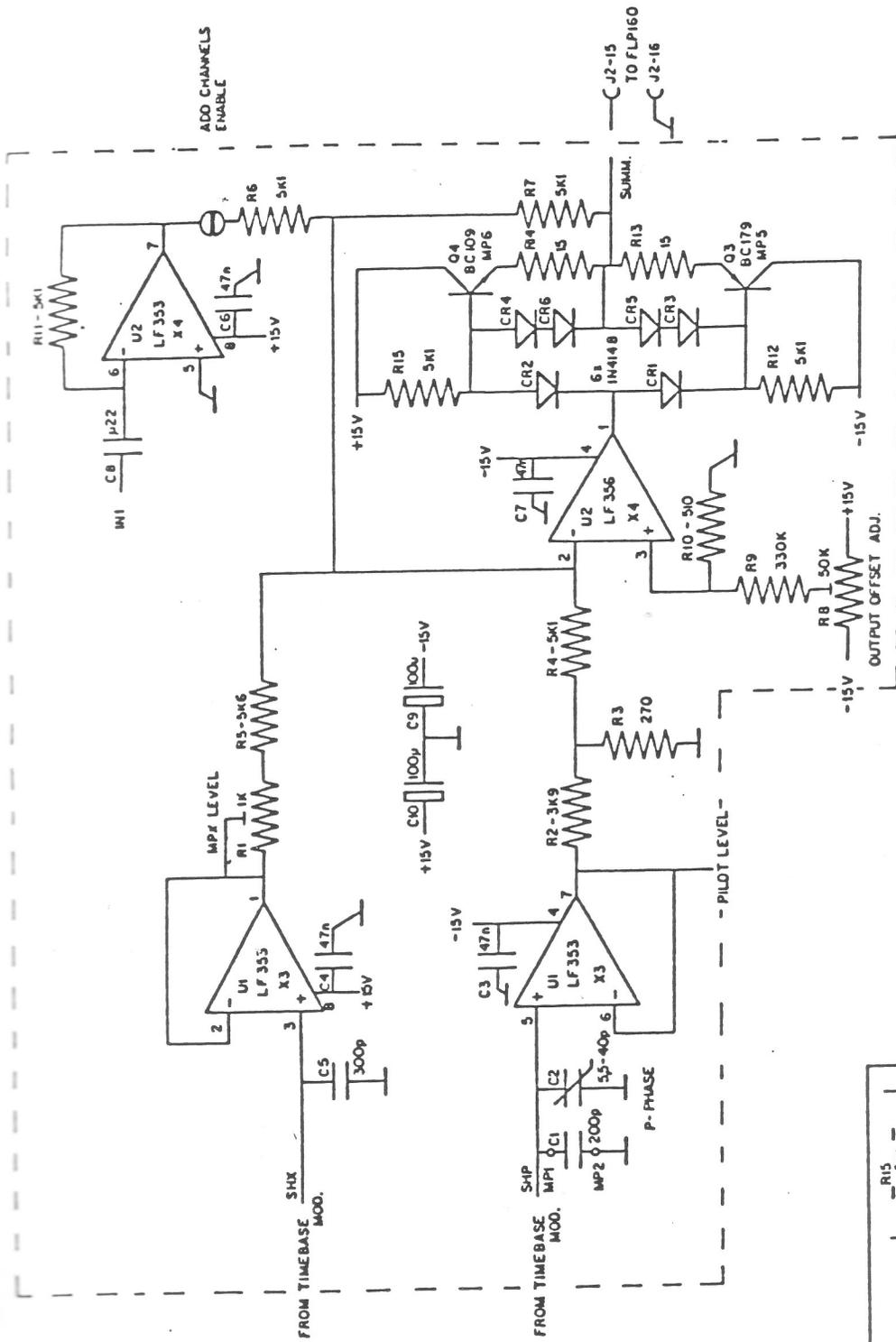
GET: 16-06-1980

CORR:

CORR: 1 2 3 4 5 6

TEK.NR:

A4-0680/07



- MP2
- C1 200p 47n X3
- C2 55-40p
- C3 47n 47n
- C4 47n 300p
- C5 5K6 5K1
- C6 47n
- C7 47n
- C8 47n
- C9 100p
- R1 1K
- R2 3K9
- R3 270
- R4 5K1
- R5 5K1
- R6 5K1
- R7 5K1
- R8 330K
- R9 50K
- R10 510
- R11 5K1
- R12 5K1
- R13 5K1
- R14 5K1
- R15 5K1
- U1 LF355 X3
- U2 LF353 X4
- U3 LF356 X4
- U4 LF353 X4
- CR1 CR3
- CR2 CR6
- CR4 CR5
- CR5 CR3
- Q3 BC179 MP5
- Q4 BC109 MP6
- C0 100p
- C10 100p

**SUMMING AMPLIFIER. A3-5 SGB-60**

GET: 17-05-1979  
CORR:  2 3 4 5 6  
TEK: NR: A3-0679/23



CORR: 19-01-1981

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITI	MANUFACT
R 51	5K1 OHM METALFILM 0,3W 1%	A-77	1	CRL
	39K OHM METALFILM 0,3W 1%	A-98		CRL
	39K OHM METALFILM 0,3W 1%	A-98		CRL
	12K OHM METALFILM 0,3W 1%	A-86		CRL
	<u>3016 B. POTMETER</u>			
R 3+4	25K OHM MULTI-TURN TOP ADJUSTM.	A-326	2	BOURNS
R 9	100K OHM RECTANGULAR MULTI-TURN	A-322	1	DALE
R 27	50K OHM RECTANGULAR MULTI-TURN	A-321	1	DALE
R 14	100K OHM MULTI-TURN TOP-ADJUSTM.	A-323	1	BOURNS
R 36	10K OHM RECTANGULAR MULTI-TURN	A-317	1	DALE
	2K OHM RECTANGULAR MULTI-TURN	A-313		DALE
<u>3111</u>				
A 3-1, A3-2	INPUT AMPLIFIER RIGHT ; LEFT		2	ROOD BV.
A 3-3, A3-4	BUFFER AMPLIFIER RIGHT ; LEFT		2	ROOD BV.
A 3-5	SUMMING AMPLIFIER		1	ROOD BV.
A 3-6, A3-8	MPX MODULE EPM 2020		2	ROOD BV.
A 3-7	TIME BASE MODULE		1	ROOD BV.

NOTES:

MOTHERBOARD 1 SGB-60

**Tratec**  
Holland

WRITTEN ON: 30-6-80

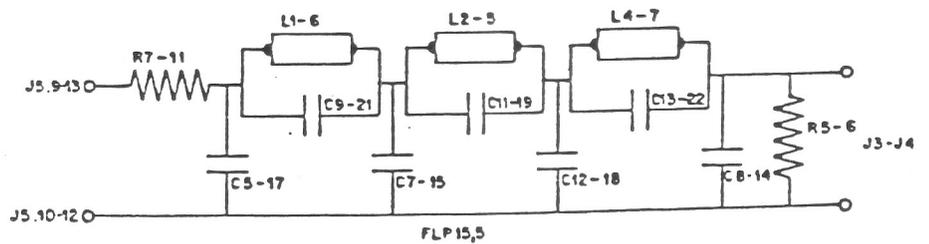
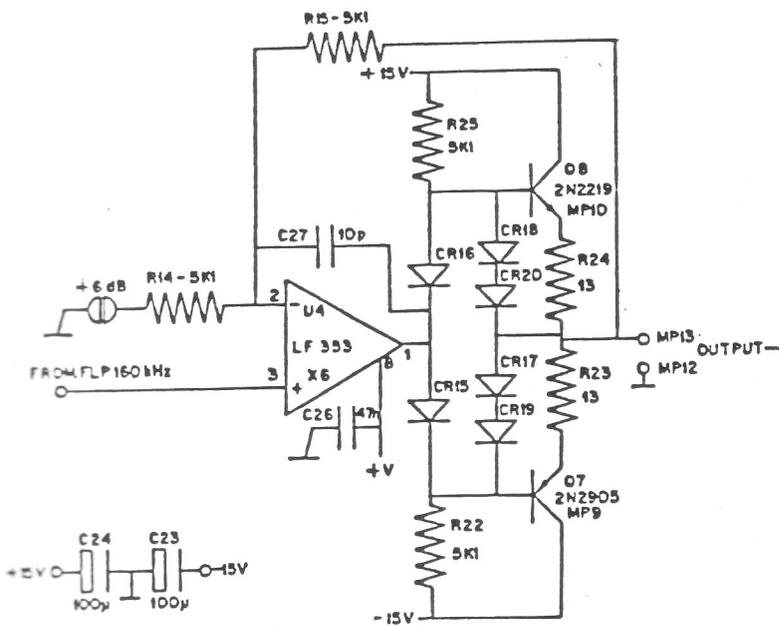
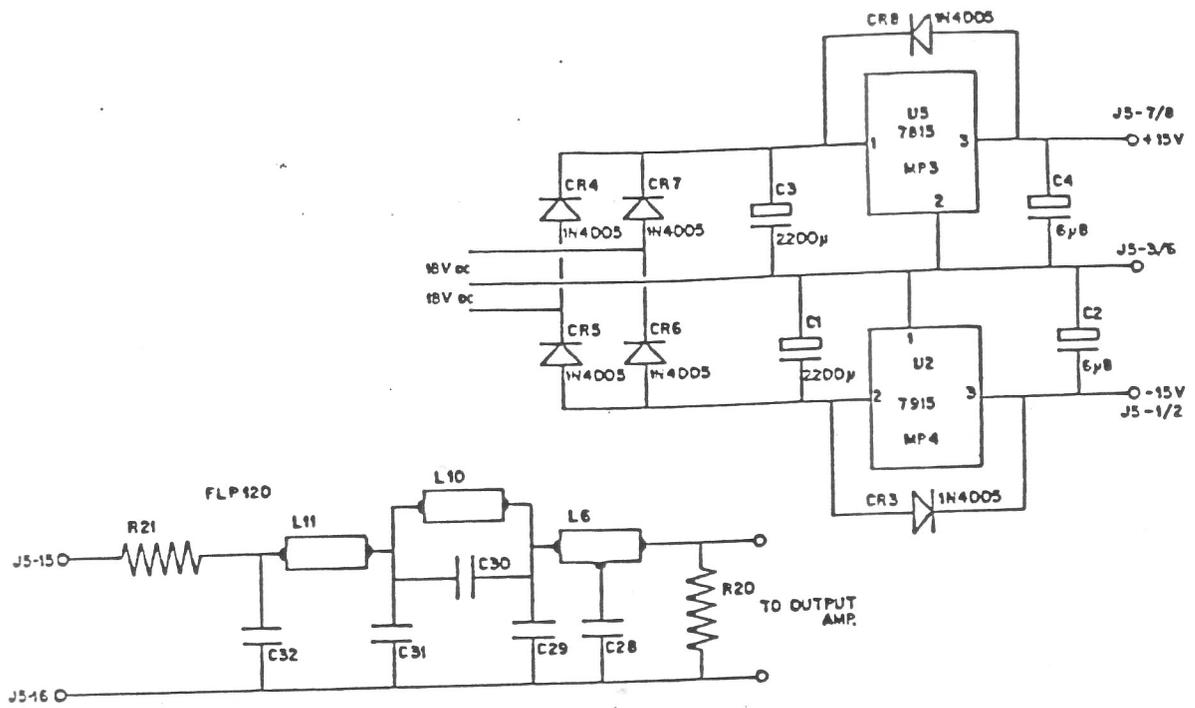
CORR: 11-5-82

REFRESHMENT: ECJ.W

PAGE 2 OF 2 PAGES

BELONGS TO DRAWING:

A3-0679/21



MOTHER BOARD 2 SUBASSY A4 SGB-60

**Tratec**  
Holland

GET: 09-06-1980

CORR: 19-01-1981

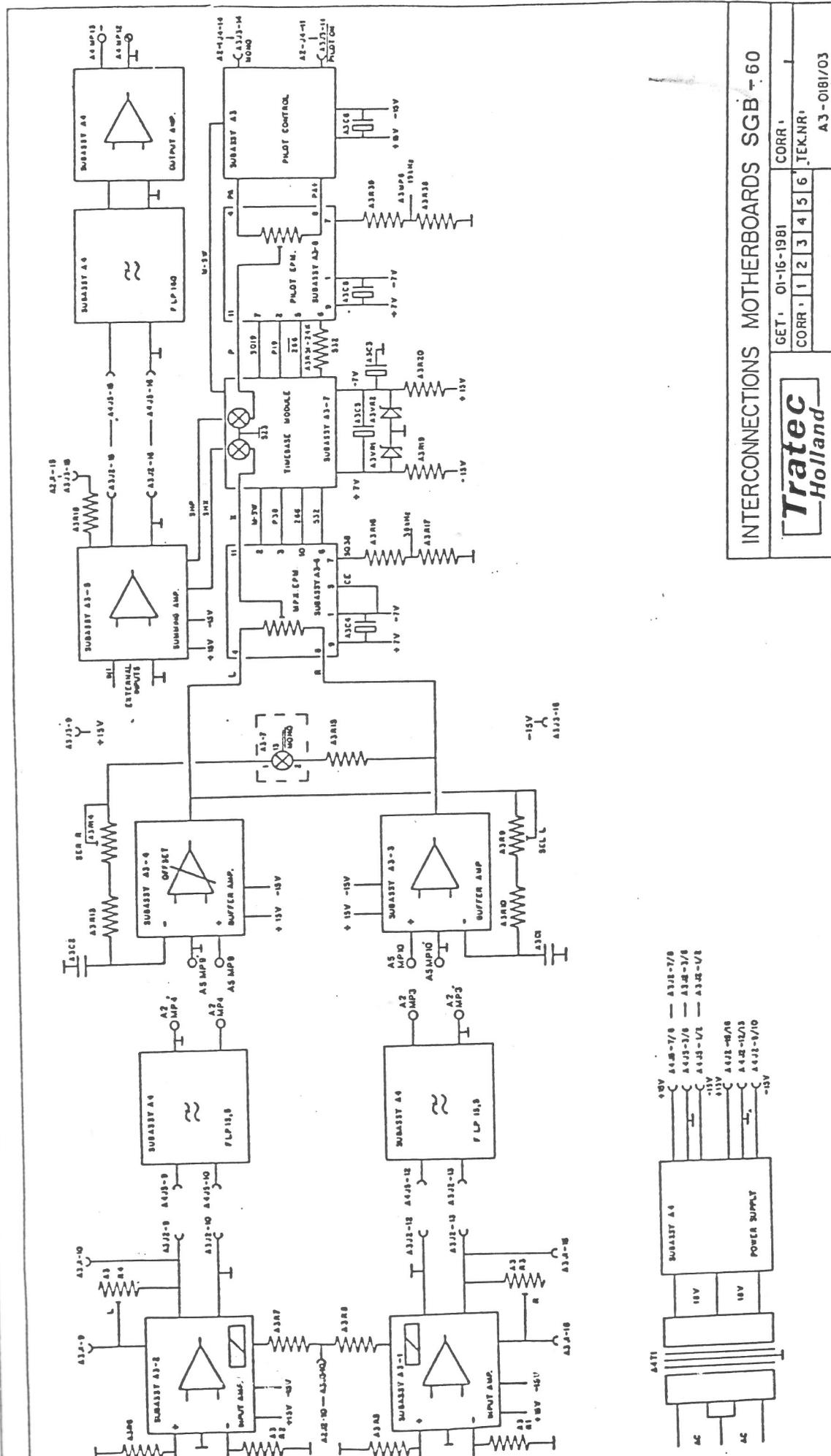
CORR:  2  3  4  5  6

TEK.NR:

A3-0679/19



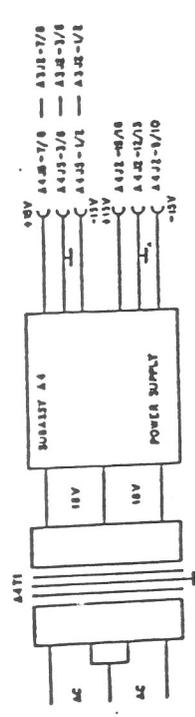


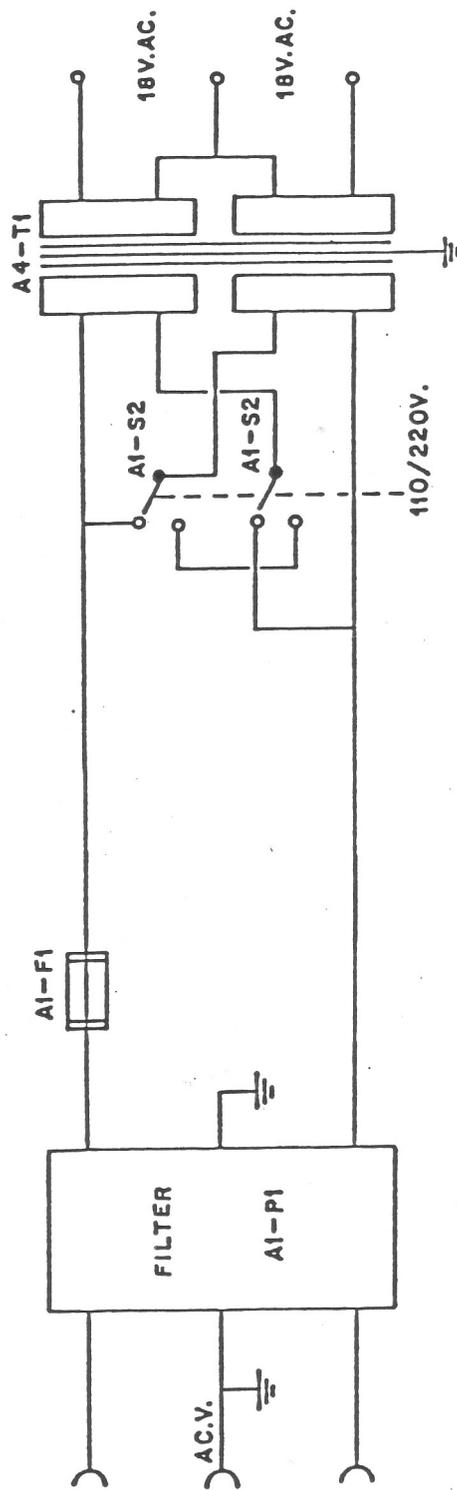


INTERCONNECTIONS MOTHERBOARDS SGB-60

Tratec  
Holland

GET: 01-16-1981  
CORR: 1 2 3 4 5 6  
TEK.NR. A3-0181/03





POWERSUPPLY 220V/110V AC. SGB - 60



GET: 19-01-81

CORR :

CORR: 1 2 3 4 5 6

TEK.NR.

A4-OIB1/O2

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITI	MANUFACT.
	<u>CONTAINS SUBASSEMBLIES:</u>			
A1	19'' UNIT CASE 1 HE		1	ROOD.BV.
A2	FRONTPANEL BOARD SC204	0981-16	1	ROOD.BV.
A3	MOTHER BOARD 1	0379-05a/b	1	ROOD.BV.
A4	MOTHER BOARD 2	0479-07a/b	1	ROOD.BV.
A5				
	<u>PARTSLIST SUBASSY A1</u>			
	<u>3001 CAPACITOR</u>			
C1	100nF POLYESTER	160V	A-140	1 ERO.
	<u>3002 CONNECTORS</u>			
J1	31-010 FEM. BNC ISOLL.		2-12	1 AMPH
J3/10	P/N65F1299 BAR STRIP		2-48	1
F1	FN322-1/01 MAINS INLET + FILTER		E-16	1 SCHAFF.
	<u>3005</u>			
MP1	19'' CASSETTE 1 HE CONTAINS 1a TO 1h			1 ROOD.BV.
1a	FRONTPANEL SC 204			1 ROOD.BV.
1b	REAR MOUNTING PLATE			2 OLTRON.
1c	SIDE MOUNTING PLATE			2 OLTRON.
1d	TOP AND BOTTOM COVER			1 ROOD.BV.
1e	SET MOUNTING PROFILE			1 OLTRON.
1f	SET SCREW AND NUTS			1 ROOD.BV.
1g	TRAFO MOUNTING PLATE			2 OLTRON.
1h	HANDLE			
MP2	IDENTIFICATION PLATE WITH SERIAL NR.		F-52	1 ROOD.BV
	<u>3012 SWITCH</u>			
S1	46256LFR SLIDE S.	ON-NONE-ON	C-7	1
	<u>3012</u>			
L1	COIL 6,8uH		1-126	1
F1	TRAFO 2 x 110V / 2 x 18V			1
	<u>3025 FUSE</u>			
F1	F396 HOLDER FOR CHASS.	5 x 20	C-229	1
F1a	100mA-220V / 200mA-110V	5 x 20	C38/C166	1

NOTES:

STEREO CODER SGB-60

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CORR: 02-06-82

REVISION: 001

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BELONGS TO DRAWING:

A3-0181/01

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITY	MANUFACT.
<u>3001 CAPACITOR</u>				
C 1+2	470pF STYRO	A-207	2	
C 6	47nF CER. DISC. 30V	A-233	1	CRL
C 7	1pF M.K.H. 100V	A-421	1	SIEMNS
C 9	10pF CER. PLATE 500V	A-176	1	PHILPS
<u>3001 D. ELECTROLYTIC</u>				
C 3	220uF AXIAL 16V	B-82	1	ROE
C 4+5+8	100uF AXIAL 25V	B-80	3	PHILPS
<u>3002 CONNECTORS</u>				
MP5/10+5/10	TERMINAL 1 POLE CERAMIC	672	13	DRALORIC
J 1/4	16 P. FEM. FLAT CABLE	1-101	4	
X 1	SOCKED 8P. DIL LOW	1-83	1	
<u>3004 C. VOLTAGE REG. DIODE</u>				
VR 1+2	BZX 55 6V8-400mW	1-34	2	SESCOS
<u>3004 H. OP-AMP</u>				
U 1	LF 353 BN DUAL	D-12	1	NATION
<u>3011 P.C. BOARD</u>				
MP 1	PRINT MOTHERBOARD 1 0379-05a/b		1	ROOD BV.
<u>3016 RESISTORS</u>				
R 1+2+5+6	22K OHM METALFILM 0,3W 1%	A-92	4	CRL
R 7+8	680 OHM METALFILM 0,3W 1%	A-56	2	CRL
R 10+13	240K OHM METALFILM 0,3W 1%	A-177	2	CRL
R 37	10K OHM METALFILM 0,3W 1%	A-84	1	CRL
R 15	1K2 OHM METALFILM 0,3W 1%	A-62	1	CRL
R 16+38	7K5 OHM METALFILM 0,3W 1%	A-81	2	CRL
R 17+39	620 OHM METALFILM 0,3W 1%	A-55	2	CRL
R 18	24K OHM METALFILM 0,3W 1%	A-93	1	CRL
R 19+20	390 OHM METALFILM 0,3W 1%	A-50	2	CRL
R 21+23+25+ 26+34	100K OHM METALFILM 0,3W 1%	A-108	5	CRL
R 22	68 OHM METALFILM 0,3W 1%	A-32	1	CRL
R 24	220K OHM METALFILM 0,3W 1%	A-116	1	CRL
	560K OHM METALFILM 0,3W 1%	A-126		CRL
	FA OHM METALFILM 0,3W 1%			CRL
	100 OHM METALFILM 0,3W 1%	A-36		CRL
	75K OHM METALFILM 0,3W 1%	A-105		CRL
	10K OHM METALFILM 0,3W 1%	A-84		CRL
	6K2 OHM METALFILM 0,3W 1%	A-79		CRL
	390K OHM METALFILM 0,3W 1%	A-122		CRL
	300K OHM METALFILM 0,3W 1%	A-119		CRL

NOTES:

MOTHERBOARD 1 SGB-60

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CORR: 11-5-82

BELONGS TO DRAWING:

REPLENISHMENT: ECJ.W

A3-0679/21

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITI	MANUFACT
	<u>3001 CAPACITOR</u>			
C 3	220nF POLYESTER 63V	A-245	1	ERO
C 4	47nF CER. DISC. 30V	A-233	1	CRL
	<u>3001 D. ELECTROLYTIC</u>			
C 1+2	100µF AXIAL 25V	B-80	2	PHILPS
	<u>3002 CONNECTORS</u>			
X 1	SOCKED 8P. DIL HIGH	1-84	1	
	<u>3004 A. DIODE</u>			
CR 1+2	SIL 1N4148	1-18	2	FAIRCH.
	<u>3004 E. TRANSISTOR</u>			
Q 2	BC 179c PNP SIL TO18	1-50	1	PHILPS
Q 3	BC 109c NPN SIL TO18	1-09	1	PHILPS
	<u>3004 H. OP-AMP</u>			
U 1	LF 356H METAL CAN SELECTED	1-55	1	NATION
	<u>3011 P.C. BOARD</u>			
MP 1	PRINT : OUTPUT AMPLIFIER 1178-24a/b		1	ROOD BV.
	<u>3016 RESISTOR</u>			
R 1	1M OHM CARBONFILM 0,3W 5%	A-132		
R 3+4	1K OHM METALFILM 0,3W 1%	A-60	2	CRL
R 5	20K OHM METALFILM 0,3W 1%	A-91	1	CRL
R 6+9	5K1 OHM METALFILM 0,3W 1%	A-77	2	CRL
R 7+8	39 OHM METALFILM 0,3W 1%	A-26	2	CRL
	<u>3016 B. POTMETER</u>			
R 2	25K OHM TOP-ADJUSTMENT M.T.	A-326	1	BOURNS

NOTES:

BUFFER AMPLIFIER SGB-60

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WRITTEN ON: 13-6-79

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CORR: 11-5-82

BELONGS TO DRAWING:

23-0679/17

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITY	MANUFACT.
<u>3001 CAPACITOR</u>				
C 1+2+6	47nF CER. DISC. 30V	A-233	3	CRL
C 3	10-40pF TRIMMER	A-177	1	PHILPS
C 4	22pF CER. PLATE 500V	A-182	1	PHILPS
C 5	47pF CER. PLATE	A-186	1	
<u>3002 CONNECTORS</u>				
X 1+2	SOCKED 14P. DIL W.W.	1-100	2	
X 3	SOCKED 16P. DIL W.W.	1-102	1	
<u>3004 K.</u>				
U 1	CD 4066 QUAD ANALOG SWITCH	D-5	1	NATION
U 2	CD 4001 QUAD NOR GATE	D-5	1	NATION
U 3	CD 4029 PRESS. UP/DOWN COUNT.	D-5	1	NATION
<u>3011 P.C. BOARD</u>				
MP 1	PRINT : TIMEBASE MODULE 1178-20a/b		1	ROOD BV
<u>3016 RESISTOR</u>				
R 1	2K OHM METALFILM 0,3W 1%	A-67	1	CRL
R 2	10M OHM CARBONFILM 0,3W 5%	A-144	1	
R 3	47K OHM METALFILM 0,3W 1%	A-100	1	CRL
<u>3019</u>				
Y 1	CRISTAL 5320000Hz	C-29	1	STABIL.

NOTES:

TIMEBASE MODULE SGB - 60



WRITTEN ON: 21-6-79	PAGE 1 OF 1 PAGES
CORR: 12-5-82	BELONGS TO DRAWING:
REPLENISHMENT: ECJ.W	A3-0679/22

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITI	MANUFACT.
J1	<u>3002 CONNECTOR</u> 16p. FEM. FLAT CABLE	1-101	1	
UR5	<u>3004a DIODE</u> sil. 1N4148	1-18	1	FAIRCH.
UR 1+2 UR 3+4	<u>3007 LED</u> RED 3mm DIFFUSE GREEN 3mm DIFFUSE	C-194 C-193	2 2	
MP1	<u>3011 PC BOARD</u> PRINT FRONTPANEL 0981-16		1	ROOD.BV.
S1+2	<u>3012 SWITCH</u> MTS106D TUMBLE ON'NONE'ON 1X	C-37	2	KNITTE.
R1	<u>3016 RESISTOR</u> 1 K OHM METALFILM 0,3 W. 1%	A-60	1	CRL.

NOTES:

FRONTPANEL SGB-60



WRITTEN ON: 23-09-81

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CDRR: 02-06-82

BELONGS TO DRAWING:

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITY	MANUFACT.
	<u>3001 CAPACITOR</u>			
C 3+7	220nF POLYESTER 63V	A-245	2	ERO
C 4+5	47nF CER. DISC. 30V	A-233	2	CRL
C 8	8,2pF CER. PLATE 50V	A-175	1	PHILPS
	<u>3001 B. ZILVERMICA</u>			
C 6	FA		1	P.I.
	<u>3001 D. ELECTROLYTIC</u>			
C 1+2	100µF AXIAL 25V	B-80	2	PHILPS
	<u>3002 CONNECTORS</u>			
X 1+2	SOCKED 8P. DIL. LOW	1-83	2	
MP 2/5	TERMINAL 1 POLE CERAMIC	672	4	DRALOR
	<u>3004 A. DIODE</u>			
CR 1	SIL 1N4148	1-18	1	FAIRCH
	<u>3004H OP-AMP</u>			
U 1+2	LF 353 BN DUAL	D-12	2	NATION
	<u>3011 P.C. BOARD</u>			
MP 1	PRINT: INPUT AMPLIFIER 1178-22a/b		1	ROOD B'
	<u>3016 RESISTOR</u>			
R 1+3+11+12	10K OHM METALFILM 0,3W 0,1%	A-349	4	
R 5+14	1M OHM CARBONFILM 0,3W 5%	A-132	2	
R 6+13	5K1 OHM METALFILM 0,3W 1%	A-77	2	CRL
R 7	390 OHM METALFILM 0,3W 1%	A-50	1	CRL
R 9	13K OHM METALFILM 0,3W 1%	A-87	1	CRL
R 10	20K OHM METALFILM 0,3W 1%	A-91	1	CRL

NOTES:

INPUT AMPLIFIER SGB-60

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CORR: 11-5-82

BELONGS TO DRAWING:

REPLENISHMENT: ECJ.W

A3-0679/15

## NOTES, MODIFICATION AND MANUAL CHANGE INFORMATION

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To keep our equipment up-to-date with the latest electronic developments, modifications can be made without being described in the manual.

This section can contain description and drawings of such modifications.

If no such change or modification pages appear following this page, your manual is correct as printed.

Because of the universal parts procurement problem, some electronic parts in the equipment may be different from described in the parts lists.

The parts used will in no way alter or compromise the performance or reliability of this equipment. They are installed when necessary to ensure prompt delivery to the customer.

Order replacement parts from the parts lists.

REF. NUMBER	DESCRIPTION	STOCK NR	QUANTITY	MANUFACT.
<u>3005</u>				
MP 2	TRAFO SUPPORT PLATE 1		1	ROOD BV
MP 3	TRAFO SUPPORT PLATE 2		1	ROOD BV
MP 15	TRAFO MOUNTING PROFILE		1	ROOD BV
<u>3011 P.C.BOARD</u>				
MP 14	PRINT : MOTHERBOARD 2 0479-07a/b		1	ROOD BV
<u>3013</u>				
L 1+6	P18/11 3B7 $\mu$ e 220		2	ROOD BV
L 2+5	P18/11 3B7 $\mu$ e 220		2	ROOD BV
L 4+7	P18/11 3B7 $\mu$ e 220		2	ROOD BV
L 9	P18/11 3D3 $\mu$ e 68		1	ROOD BV
L 10	P18/11 3D3 $\mu$ e 68		1	ROOD BV
L 11	P18/11 3D3 $\mu$ e 68		1	ROOD BV
<u>3015</u>				
MP 4+5	6070A HEATSINK TOR TO220	B-79	2	THERHL
<u>3016 RESISTOR</u>				
	22K OHM METALFILM 0,3W 1%	A-92		CRL
	560 OHM METALFILM 0,3W 1%	A-54		CRL
R 5+6+7+11	4K7 OHM METALFILM 0,3W 1%	A-76	4	CRL
R 21	680 OHM METALFILM 0,3W 1%	A-56	1	CRL
R 9+10	10 OHM METALFILM 0,3W 1%	A-12	2	CRL
R 14 + 15				
22+25	5K1 OHM METALFILM 0,3W 1%	A-77	4	CRL
R 20	1K OHM METALFILM 0,3W 1%	A-60	1	CRL
R 23 + 24	13 OHM METALFILM 0,3W 1%	A-15	2	CRL
<u>3024</u>				
	RH 23 RELAIS			NATION
MP 7 + 8	TRANSISTOR ISOLATION PAD TO5 RED	672	2	BARNS

NOTES:

MOTHERBOARD 2 SGB-60

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WRITTEN ON: 10-6-79

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CORR: 12-5-82

BELONGS TO DRAWING:

REFRESHMENT: ECJ.W

A3-0679/19

REF. NUMBER	DESCRIPTION	STOCK NR.	QUANTITI	MANUFACT.
<u>3001 CAPACITOR</u>				
C 25+26	47nF CER. DISC. 30V	A-233	2	CRL
C 27+33	10pF CER. PLATE 500V	A-176	2	PHILPS
<u>3001 B. ZILVERMICA</u>				
C 5+17	FA		2	P.I.
C 7+15	FA		2	P.I.
C 8+14	FA		2	P.I.
C 9+21	FA		2	P.I.
C 11+19	FA		2	P.I.
C 12+18	FA		2	P.I.
C 13+22	FA		2	P.I.
C 28	FA		1	P.I.
C 29	FA		1	P.I.
C 30	FA		1	P.I.
C 31	FA		1	P.I.
C 32	FA		1	P.I.
<u>3001 D. ELECTROLYTIC</u>				
C 1+3	2200µF AXIAL 40V	B-127	2	ROE
C 2+4	6,8µF AXIAL 63V	A-264	2	PHILPS
C 23+24	100µF AXIAL 25V	B-80	2	PHILPS
<u>3002 CONNECTORS</u>				
J 5	16P. FEM. FLAT CABLE	1-101	1	
MP 12+13	TERMINAL 1 POLE CERAMIC	672	2	DRALOR:
X 6	SOCKED 8P. DIL. LOW	1-83	1	
<u>3004 A. DIODE</u>				
CR 9/14+	SIL. 1N4148	1-18	12	FAIRCH
CR 15/20	SIL. 1N4005	1-21	6	FAIRCH
CR 3/8				
<u>3004 E. TRANSISTOR</u>				
Q 7	2N2905a PNP SIL. TO5	1-62	1	MICRO
Q 8	2N2219a NPN SIL. TO5	1-61	1	MICRO
<u>3004 H. OP-AMP</u>				
U 4	LF 353BN DUAL	D-12	1	NATION
<u>3004L. VOLTAGE REGULATOR</u>				
U 2	7915 NEG. TO220	1-147	1	NATION
U 3	7815 POS. TO220	1-146	1	NATION

NOTES:

MOTHERBOARD 2 SGB - 60



WRITTEN ON: 10-6-79

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CORR: 12-5-82

BELONGS TO DRAWING:

REPLENISHMENT: ECJ.W

A3-0679/19



## **Tratec** **Holland**

TRATEC PRODUCT RANGE:

TV MODULATORS  
FM PROCESSORS  
FM MODULATORS  
STEREO GENERATORS  
TRANSCODERS  
VIDEO TEXT SYSTEMS  
DISH ANTENNAS

DISH POSITIONERS  
DOWNCONVERTERS  
SATELLITE RECEIVERS  
SPLITTERS  
DIRECTIONAL COUPLERS  
CONNECTOR ADAPTORS  
ATTENUATORS

WALL OUTLETS  
F-TYPE CONNECTORS  
AMPLIFIERS  
COAXIAL RELAYS  
MULTITAPS  
PAY TV FILTERS  
MEASURING EQUIPMENT